SCIENTIFIC AMERICAN

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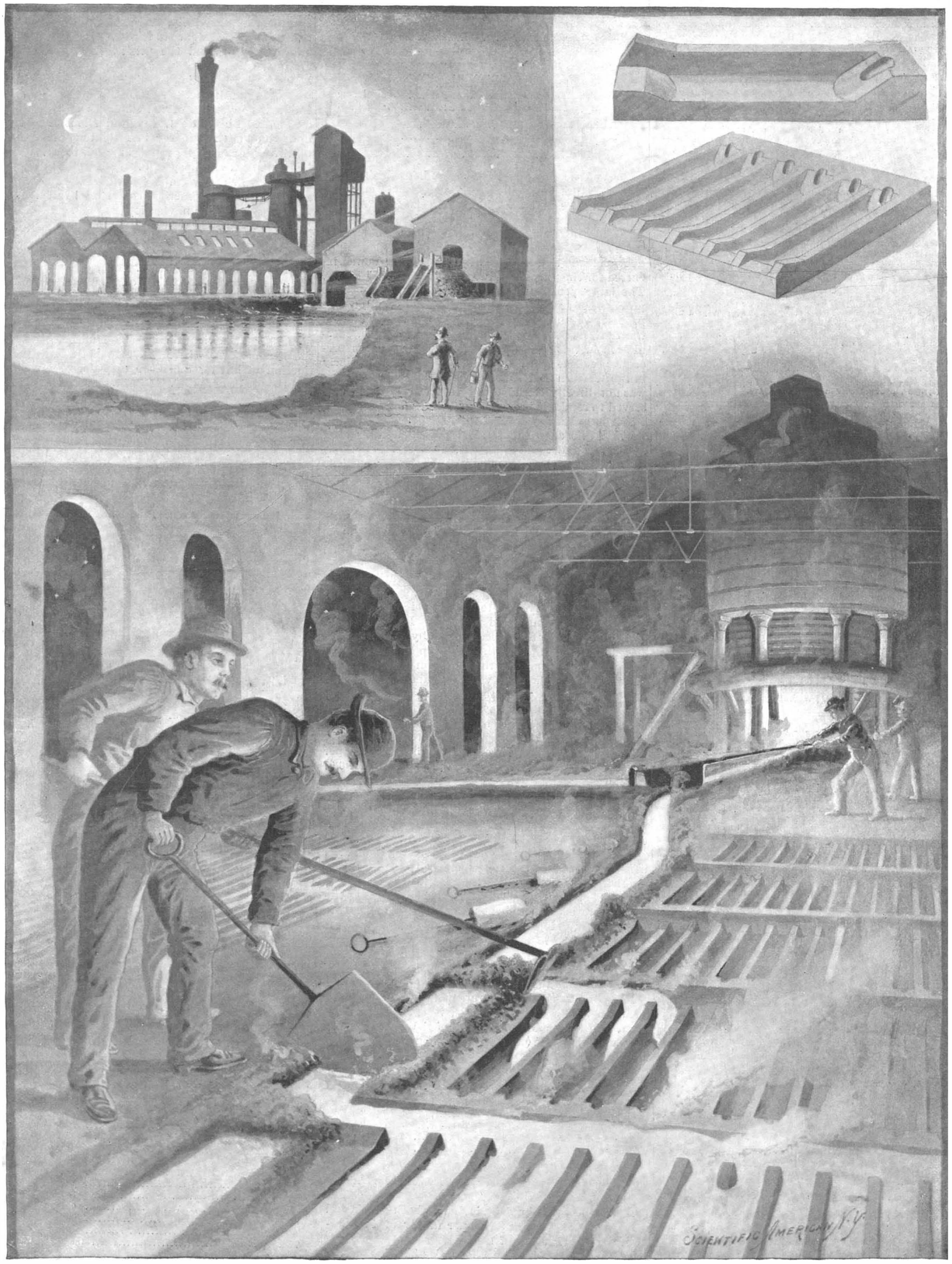

THE "ALICE" FURNACE, BIRMINGHAM, ALABAMA.—[See page 391.]

Scientific American.

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NEW YORK. SATURDAY, DECEMBER 21, 1895.

Contents.

(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 1042.

For the Week Ending December 21, 1895.

Price 10 cents. For sale by all newsdealers.

PRIVATE AND PUBLIC DEBT IN THE UNITED STATES.

The production and trade of a country necessitate an elaborate system of debts and credits which increase proportionately to the magnitude of its commercial operations.

According to the Official Bulletin, the minimum private and public debt of the United States for the year 1890 was $20,227,170,546. Of this sum, $6,200,000,000 represents the debt of quasi public corporations, under which head are included railroad companies, street railways, telegraph, public water, electric and gas companies, etc., 91·44 per cent of this, or $5,669,431,114, being the debt of the railroad companies alone.

The debts of individuals and private corporations reach a total of $12,000,000,000, divided as follows:

Real estate mortgages	$6,019,679,985
Crop liens in the South	300,000,000
Crop liens outside of the South	350,000,000
National banks, loans, etc	1,904,167,351
Other banks, loans and overdrafts	1,172,918,415
National, State and local taxes	1,040,473,013
Other net private debt (estimated)	1,212,761,236
Total private debt	$12,000,000,000
Total for public corporations (as above)	6,200,000,000
Total	$18,200,000,000

The public debt, less sinking fund, in which debt is included that of the United States, States, counties, municipalities and school districts, is $2,027,170,546, which, added to the private debt, makes a total of all kinds for the country of over twenty billions.

It is significant that over 58 per cent of the combined debt on farms and homes occupied by owners was incurred for the purpose of the purchase of real estate. The large profits which were realized by the earlier purchasers or original owners of inside and outside property in and around the rapidly growing cities of the States encouraged an abnormal amount of speculation in this direction during the few years preceding the late crisis. In the middle, and particularly in the Western States, this form of speculation, if it was not directly contributory to the crisis, certainly served to render it very acute when it came.

The crop liens of the South are a legacy of the civil war. At its close the farmers possessed their land and a few mules and tools, but no money. The merchants furnished supplies in consideration of crop liens and mortgages on farm stock. The system thus begun has continued to the present day.

The loans from banks are obtained on the understanding that they are for capital.

The tax debt and the public debt are incurred "for the maintenance of justice, the promotion of public works and for education."

From the above categorical view of the various kinds of debt that go to make up the total for the country, it is seen that fully nine-tenths were incurred in the acquisition of capital and property. Less than one-tenth represents "debt necessitated by misfortune."

Next in importance to the question of the amount of debt of the country is the question of the rate of interest upon which the various loans were granted. The average rate of interest on railroad debts is 4·50 per cent; on street railways, telegraphs, etc., 5·89 per cent; on real estate mortgages, 6·60 per cent; bank loans and over-drafts, 6·60 per cent; crop liens outside the South, 10 per cent; crop liens in the South, 40 per cent; making an average rate on private debts of 6·67 per cent.

The rate on the United States public debt is 4·08 per cent; and on States, counties, and municipalities, 5·29 per cent. The average rate of interest on the total indebtedness of the country is 6·44 per cent.

Referring to the ruinous rate of interest paid on crop liens in the South, the report states that "extensive inquiries, answered by merchants and cotton buyers, who hold crop liens, point to the conclusion that the average rate on these liens must be as high as 40 per cent, rarely going as low as 25 per cent, and often going as high as 75 per cent and more"!

The relatively low rate of 4·08 on the debt of the United States is partly explained by the fact of its exemption from taxation.

Referring to the average rate of interest of 6·60 per cent on real estate mortgages, it should be noted that, in the case of farms occupied by owners, this rises as high as 7·07 per cent and 7·36 per cent on acre tracts.

The percentage of debt to wealth is for:

Railway companies	67·48 per cent.
Street railways and telephone companies	66·60 "
Incumbered farms occupied by owners	35·55 "
Incumbered homes occupied by owners	39·77 "
Taxed real estate and untaxed mines	16·71 "
The whole United States	31·10 "

The total wealth of the United States corresponding to the total debt of over $20,000,000,000 is about $65,000,000,000.

The total per capita debt, including both public and private debt, is $323, or $1,594 per family of 4·93 persons, as per the census of 1890.

In connection with the above classification of the various forms of indebtedness, public and private, it is satisfactory to learn that there was a total increase of wealth, during the ten years from 1880 to 1890, of $21,395,091,197; the increase for the year 1889 to 1890 being nearly three billions of dollars.

NEW YORK THE BIRTHPLACE OF OCEAN STEAM NAVIGATION.

Doubtless the majority of the readers of the SCIENTIFIC AMERICAN have a more or less distinct impression that New York was in some degree associated with the development of the first steamboat; but it will, no doubt, be a pleasant surprise to learn that this city has a threefold claim to be called the cradle of the steamship. The first practical river steamer, the first vessel propelled by steam to make a deep sea voyage, the first transatlantic steamship, and the first steam warship, all owed their existence to the inventive genius of New York designers and the practical skill of New York craftsmen.

In drawing attention to this interesting coincidence, we would not detract from the fame and credit due to the earlier inventors of the sixteenth and eighteenth centuries. Blasco de Garay and Denis Papin were undoubtedly the pioneer investigators of the possibilities of steamship propulsion, and, to a certain extent, they proved its possibility; but the mechanical forms in which they embodied their ideas were crude and possessed no practical commercial value. While the theory of steam navigation was old, centuries old, it required some master mechanic to embody this idea in practical, mechanical shape, and this was what Robert Fulton, associated with R. Livingston, accomplished, when, on August 7, 1807, he saw his first steamer, the Clermont, cast off her moorings at the New York docks and start on her maiden trip to Albany.

To Colonel John Stevens, and, indirectly, to a monopoly of navigation on the Hudson, granted to the owners of the Clermont, New York owes the distinction of having built the first deep sea steamer; and the credit of building the first steamer to make a transatlantic passage is shared by New York conjointly with Savannah, Ga. The Savannah having been built at New York and engined at the Southern seaport.

Of scarcely less historic interest than the Clermont is the battle ship Fulton the First, which was named after the designer, and testifies yet further to his inventive genius.

Like the other pioneer ships in their respective classes, the Fulton was built in New York ship yards, and thus clearly establishes this city's claim to be called the cradle of the modern steam battle ship.

A cut of the original plans for this vessel will be found in the SCIENTIFIC AMERICAN SUPPLEMENT for April 21, 1894. The dimensions of this vessel prove that Fulton had the courage of his convictions, for her displacement was greater than that of the average three-decker of that period, and considerably over that of the Victory, which carried Admiral Nelson at the battle of Trafalgar.

The Fulton the First showed a trial speed of over 6 miles an hour, which was far above the average, day in and day out, speed of the fleetest sailing frigates of those times.

In many details she anticipated the modern war ship; as, for instance, in the provision that she should be "furnished with four submarine guns, to discharge a hundred pound ball into an enemy, ten or twelve feet below her water line." The cross section shows that her engines and boilers were placed low down in the hold, and that the portion above the water line was protected by side armor of 5 feet of oak, an amount which was certainly impenetrable by the ordnance of that date.

It is unquestionable that, with her greater maneuvering power, her 100 pounder guns, and the superior protection afforded to the gunners, she would have proved more than a match for the best ship of the line of that date. The close of the war of 1812 prevented her from testing her strength against the English ships; but tradition has it that the appearance of this 2475 ton monster, gliding swiftly down the bay, with no visible means of propulsion, struck terror into the "indomitable heart" of the British tar!

Analysis of Emerald.

The author has operated on the emerald of Limoges (Chanteloube, Haute Vienna). He gives the following results:

	I.	II.
Loss at a red heat	1·46	1·41
Silica	66·06	65·80
Alumina	16·1	16·40
Glucose (? should be glucina)	14·33	14·21
Ferric oxide	1·2	0·9
Mn_3O_4	—	—
Magnesia	0·55	0·61
Lime	0·17	0 14
Phosphoric acid	0·11	0·09
Alkalies	—	—
Titanic acid	traces	traces
	100·11	99·67

—P. Lebeau.

Cycle Notes.

All cyclometers should be provided with some means of correction. It is nothing unusual to find them from three to five per cent out, owing, very likely, to the varying diameter of the wheel, depending on whether the tire is fully inflated or not. A new cyclometer is on the market which registers not only 10,000 miles, but has also a special dial for indicating the miles made on a single trip. Another dial marks the fraction of a mile.

November 22 the doors of the Agricultural Hall, London, were thrown open for the nineteenth cycle exhibition, in the name of the Stanley Club. An eager crowd of visitors was immediately admitted to mark the improvements, alterations, and innovations that were proposed for cycles and their accessories for next season's mounts.

The Simpson lever chain was one of the first of the exhibits to receive long and careful attention.

The auto-cars, the bi-tricycles and the motor cycles next received a due share of rapt attention, public interest after these exhibits had been visited becoming more general and spreading itself out impartially over the various mechanical devices thought out by the different firms and brought together under one roof by the enterprise and perseverance of the Stanley show promoters.

There are, comparatively, but few three-wheelers on exhibition, and even these few, beautifully constructed and finished as they are, receive but scant notice. There is no doubt about the matter that the bicycle is the machine for both men and women.

One of the many interesting features introduced was the display of many forms of dress considered suitable for cycling.

The extensive photographic collection in the gallery attracted attention. It is becoming more and more popular for the snap shot photographic apparatus to be numbered among the ordinary necessaries of the cycling tourist's outfit, and the enlargements exhibited as the result of snap shot photography certainly suggest that the art is one that is to become of far more widespread interest than it is, even at the present stage of photographing enthusiasm. One of the great attractions of the Stanley has proved to be a machine shown by the makers of the Gladiator, boasting a 2½ inch tread.

The relay ride from Washington to New York City was ended Monday morning, December 2, in New York, at 4:48 o'clock, when Lieutenant Libby and Private Pilkin delivered to Lieutenant Donovan, on Governor's Island, the message from General Miles, who started it from Washington, Sunday, at 7 o'clock in the morning.

The roads were execrable, the riders say, and it was often almost impossible to remain in the seat. Each rider carried ten rounds of ammunition and the regulation army pistol. The uniform consisted of a blouse, campaign hat, gauntlet, gloves and bloomers.

The race was suggested by General Miles, who is making severe tests of the bicycle in the hopes of having it generally adopted in the army. It would have been difficult to have selected a harder ride than was taken by these men, and the wheels, in each instance, stood up remarkably well.

Manufacture of Lead Pencils.

The Monde Economique, quoting from a work recently issued by Ernest Faber on the manufacture of lead pencils, published on the occasion of the business of Johann Faber, of Nuremberg, being turned into a limited company, says that there are twenty-six manufactories of lead pencils in Bavaria, twenty-three of which are at Nuremberg. These employ 9,000 or 10,000 workmen, and turn out 4,400,000 lead pencils every week. In the above number of workmen are not included turners, boxmakers, etc. The factory of Johann Faber alone turns out 1,280,000 pencils per week. The protective customs duties of the United States prohibit the importation of cheap pencils, and this country itself turns out almost as many pencils as all the Bavarian factories put together. The best cedar wood of the States (Cedrus virginiana) will soon be exhausted, but at present, having the monopoly of internal production, a considerable amount is exported to India, Mexico, Japan, and Australia, at extraordinarily low prices. The duties in Italy (100 lire per 100 kilogrammes), in France (180 to 300 francs per 100 kilogrammes), and in Russia (35 copecks per pound) are also hindrances to importation. In France, it is stated that schools and government offices, and even railway companies, are forbidden to buy German pencils.

In the United States excellent lead pencils are now being made of paper, which is wound spirally upon the lead.

The Blacksmith.

In our description of this celebrated painting, in our last week's issue, we regret to note that the address of Mr. F. E. Galbraith, the owner of the painting, was omitted. The picture can now be seen at No. 19 West Twenty-fourth Street, New York, where we understand it is to remain for some time.

Hair Worms and Their Hosts.

BY HARRY MOORE.

At Betchworth, Surrey, just where the road crosses the River Mole, I picked up a specimen of Pterotichus madidus, Fab., from which, upon being placed in the cyanide bottle, a Gordius aquaticus, L., endeavored to escape. About three inches of it extrude, and, judging by its girth, an equal or greater length remains inside, yet the abdomen of the beetle is but nine millimeters in length.

Nearly every observer of the slightest experience has some acquaintance with hair worms, even if it is only a hazy recollection of the horse hair legend of his school days. Numerous notes are scattered through the early volumes of Science Gossip and a further one upon the variety of the hosts Gordius infests may not be unacceptable. The family Nematoidæ, to which the Gordiaceæ belong, contains many species of more than ordinary interest, first on account of their curious cycle of development, and then their value in the economy of nature, for not only are they in a measure beneficial in checking over-production in certain insects, but more or less dangerous when introduced into the human system. Their life history may be briefly described as follows: The eggs are laid in long strings; upon hatching, the young larva bores through the membrane, and for a short period lives a free aquatic life. It then becomes parasitic upon various fly larvæ, etc.; these hosts in their turn are devoured by other creatures, and the worms become incepted in their intestines, where they remain some months, finally making their way into the intestinal cavity and escaping per ano in due course.

It is rather singular, however, that, whereas hair worms are most commonly found infesting beetles in England, they prefer the orthoptera (grasshoppers and allied insects) in America. In both countries spiders have been noted as hosts, in America the human being, and an instance has come under my own notice where there was strong presumptive evidence the worm had been voided by a sparrow. Various writers cite fishes and frogs, and several mention caterpillars, but the parasites observed in lepidopterous larvæ probably belonged to the allied genus Mermis. In America, Mermis acuminata, Leidy, has been observed in the larvæ of the codlin moth (Carpocapsa pomonella, L.) and a similar parasite has been seen in larvæ by several of our London workers.

In enumerating the hosts of Gordius aquaticus, the common European hair worm, several difficulties arise, for whereas, as I have already mentioned, carnivorous beetles are chiefly infested this side of the Atlantic, the observers do not always seem to have determined their species. Several references of this sort will be found in Science Gossip (vol. i, page 198, vol. xii, page 71, vol. xv, page 281, etc.) If any of our present readers can furnish something more definite, we shall be able to get along with our list. I have come across no mention of coleoptera being infested in America, in any note to which I have access; but the following are some of the authenticated instances among the orthoptera:

G. aquaticus has been found in the cricket (Gryllus neglectus) and in Acheta abbreviatus, Serville—the short winged field cricket found in woods beneath logs and stones; Gordius robustus, Leidy, infests Stenopelmata fasciata, Thomas, one of the stone or camel crickets usually found beneath stones and along the margins of woodland streams and logs, and in damp woods (Blatchley), and Orchelimum gracile, a grasshopper confined to low moist meadows; A. Gordius (species ?), eight and a half inches long, has been taken from a pupa of Xiphidium ensiferum, Scudder, whose perfect body measures but half an inch in length. The life history of this orthopteron is of exceptional interest, the ova being deposited from several up to one hundred and seventy "in the turnip-shaped galls produced by a small fly belonging to the Cecidomyidæ on certain species of willow (Salix cordata, etc.)"

I have now but to mention Caloptenus spretus, Thomas, the Rocky Mountain locust, which is infested with G. aquaticus, Linn., and G. varius, Leidy, although repeated dissections by various American observers (Riley, Whitman, etc.) have shown that not more than a small percentage of the locusts are infested, yet when we consider the loss incurred annually in the United States from locusts alone is estimated at £8,000,000, anything which tends to mitigate the plague becomes of importance.

The question, How are we to account for the presence of these aquatic parasites inside terrestrial insects? upon consideration, is not of easy solution. Of course they are introduced with their food while in a minute immature state, but whether as ova or larvæ I think there is room for discussion. It will be noticed all the insects mentioned are associated with damp places that are more or less subjected to floods; but I don't think that sufficient reason for believing they have all fed upon the various aquatic fly larvæ in which the hair worm larvæ are said to pass their first period of larval life, though in the case of grasshoppers Packard thinks they swallow them as larvæ. I am inclined to believe there are several points in the life history of these parasites yet to be cleared up; perhaps some of our microscopists can elucidate them.—Science Gossip.

Archæological Discoveries.

Another ancient Greek hymn set to music, recalling the discovery made in the latter part of 1893 (vol. iii, page 866, of Current History, published by Garretson Cox & Company, Buffalo, N. Y.), has been brought to light by the French excavations at Delphi. It is inscribed on two large slabs of stone, which have been unearthed in the building described by Pausanias as the "Treasury of the Athenians."

The find of 1893 included fourteen fragments of various sizes, four of which were distinguished from the others by a difference in the notation of the music. These four were introduced to the public last year as the "Hymn to Apollo" (vol. iv, page 251). The latter find includes another large fragment, to which the remaining ten of the first discovery can be adjusted, thus giving us a second hymn. The decipherment and transcription of the words and music have, as before, been intrusted to MM. Henri Weil and Theodore Reinach.

The purport of both the hymns is substantially the same. After an invocation of the Muses, the poet gives various legends of Apollo's life and works, ending with the slaughter of the Gauls at Delphi in 279 B. C.; and then implores the god's protection for Delphi and Athens and the government at Rome. The date is, therefore, after 146 B. C., when the Romans took possession of Greece. Apart from the music, the hymns are not particularly interesting.

The duration of the musical notes is indicated by the syllables that were sung with them. Thus, for example, where three notes are attached to a word of one long syllable followed by two short syllables, they answer roughly to a crochet followed by two quavers. The pitch of the notes is indicated by various letters of the alphabet. In the first hymn the letters were those that the Greeks prescribed for use with voices; but in this second hymn they are those that were prescribed for use with instruments. As the Delphians would not likely have written down the accompaniment and omitted the song itself, it is supposed that the instruments and voices were here in unison.

A discovery of importance for the history of early Christian literature is credited to Dr. Karl Schmidt, of Cairo, Egypt. In the library of the cloister of Ackmim—the same library in which the Gospel and the Apocalypse of Peter and Apocalypse of Elijah were found—Dr. Schmidt recently came across an old Coptic manuscript containing a record of conversations between Christ and his disciples. Both the beginning and the conclusion have been lost through mutilation of the manuscript.

The chief subject of conversation is the resurrection of Christ, which is reported in detail and in such a manner as to combine the narratives of the four gospels. The object of the writing is to warn the reader against unbelief, especially gnosticism. There is a long discussion of the resurrection of the body. The work shows itself to be an apocryphal missive of the apostles to the congregations, and reveals the congregational orthodoxy in the early church. Like the Apocalypse of Peter, it shows also that the church was not always able to resist the temptation of following the gnostic trend of thought. Its date, approximately, is 160 A.D.

The Pasteur Institute's Farm.

The New York Therapeutic Review says that a farm of about 200 acres of land, in the vicinity of Tuxedo Park, New York, one hour's ride from the city, has been purchased for use as an experimental station for the New York Pasteur Institute.

The farm, which is already provided with ten cows and the antitoxin horses and mules of the institute, will receive in addition many donkeys, goats, sheep, dogs, rabbits, guinea pigs, etc., for which especial barns are now being built, and also a laboratory for the preparation of the antitoxic serums, vaccine virus and other biological products.

Research will be conducted there upon infectious diseases of animals as well as of man.

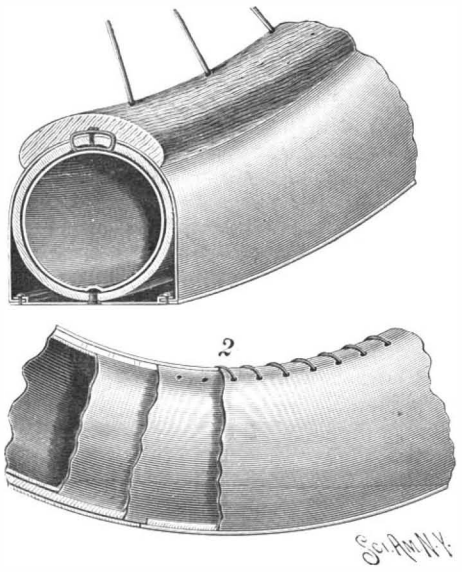
The extensive character of the work done at the institute rendered indispensable the establishment of this experimental station.

Synthetic Formation of a New Ketonic Acid.

The compound in question has been obtained by the action of camphoric anhydride upon benzine in presence of aluminum chloride. Its composition is $C_{15}H_{20}O_2$. It forms white crystals of a nacreous luster which melt at 135—137° and boil at 320° at a pressure of 760 mm. They are almost insoluble in water, sparingly insoluble in ligroine, but readily soluble in acetic acid, alcohol, ether, benzine, chloroform, and carbon disulphide. The author has formed and examined its ammonium, barium, silver, copper, cobalt, nickel, zinc, and lead salts. He has also obtained its ethylic and methylic ethers, its anhydride, amide, and hydrazide.—E. Burker.

A METALLIC TREAD PNEUMATIC TIRE.

A tire having a metallic tread secured to the tubular inflated rim, obviating the liability to puncturing the tire or other injury when the wheel passes over sharp objects in the road, is represented in the accompanying illustration, and has been patented by Frank M. Growney, of No. 986 Washington Avenue, New York City. The tubular rim is secured in the usual manner to the felly, and the metallic tread, consisting preferably of a continuous strip of mild steel, is attached to the outer part of the rim by rivets, as shown in Fig. 1, the outer sides of the tread being engaged by the sides of bands fastened in place by clamping strips. The

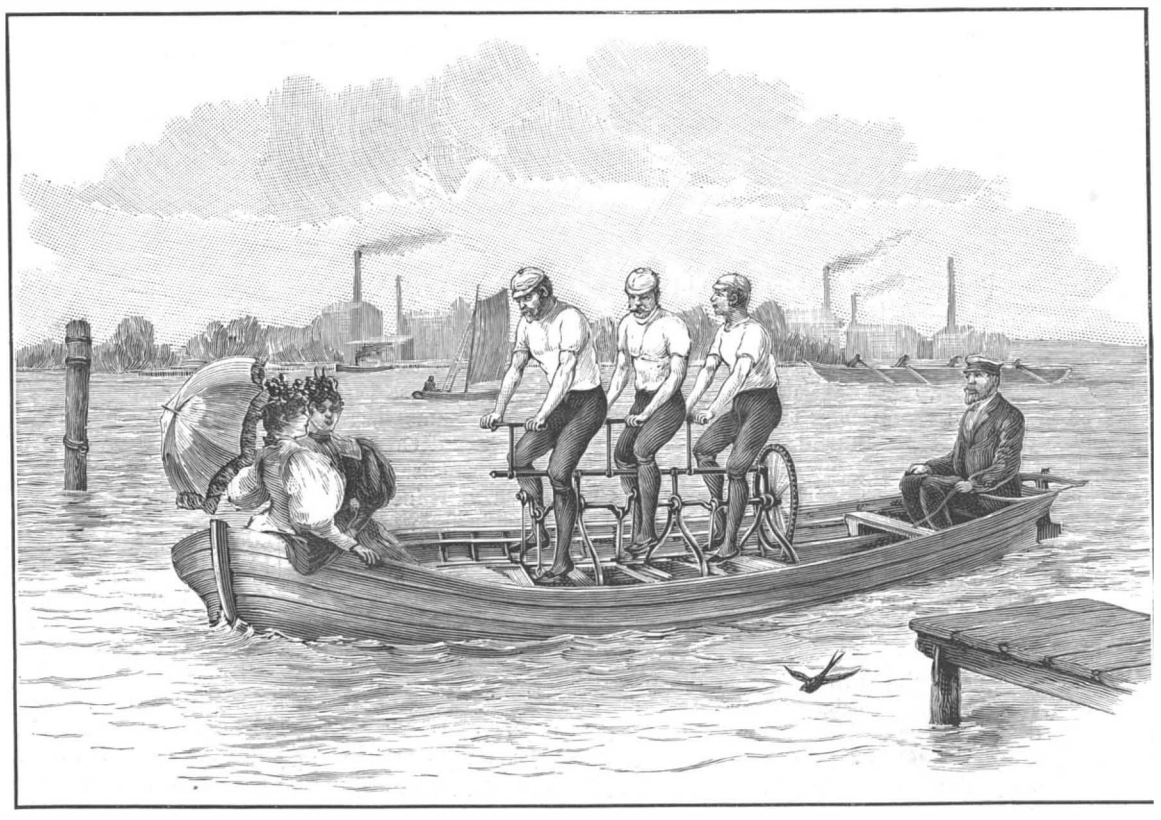


GROWNEY'S PNEUMATIC TIRE.

bands extend around the sides of the rim, and are connected by the usual lacing with the inner ends of the rim, the lacing also attaching the inner ends of the rim to each other. Fig. 2 is a side sectional view of the improvement. The rim, as will be seen, is protected by the side bands, as well as by the continuous metallic strip forming the tread.

NAJORK'S FOOT MOTOR BOAT.

Just now, when so many are devoting their time and attention to the various means of transportation, trying to discover the quickest way of moving us mortals from one place to another over both the land and the sea; when steam, electricity, petroleum, benzine, etc., have entered the lists against the muscles of the horse, and even of human beings, we are sure that our readers will be interested in the motor shown in the accompanying engravings, for which we are indebted to the Illustrirte Zeitung. This boat is propelled by a screw driven by foot power, and is operated by three people, the one nearest the stern also steering. The wheel visible behind the last operator transmits motion to the shaft and through the latter to the propeller. By various arrangements of the three cranks dead centers can be avoided. For every 60 movements of the treadles the screw revolves 500 times. In this way even unskilled operators can travel about five miles an hour. A great advantage of this boat is that it can also be propelled by oars or sails, and the simple apparatus can be applied to any boat that is sufficiently broad. As the three operators sit quite high, a counter weight of lead should be placed in the keel. The Najork boat has created quite a sensation in boating circles.



NAJORK'S FOOT MOTOR BOAT.

The Chicago Police Telephone System.

Chicago has a complete telephone and signal system, consisting of 887 public and 370 private boxes, operating on 81 circuits, connected with the 37 precinct stations of this department, in which they are located. The system includes public sentry boxes placed at street intersections, equipped with a signal box to transmit the number of the station; a telephone for patrolmen to report and receive orders over; a chemical register at the station which records the calls, and the necessary switches for operating the telephone and testing for electrical disturbances.

Silver from Silver Bromide.

Silver is usually recovered from silver bromide wastes, incident to photographic processes, by mixing them with nine-tenths their weight of calcined sodium carbonate, and fusing in a crucible, whereby carbon dioxide and oxygen are given off. Metallic silver gathers at the bottom of the crucible, and a double salt of sodium carbonate and sodium bromide floats on top as a clear liquid. On cooling the crucible down to a red heat the silver solidifies, and the flux, still in a liquid state, may then be easily poured off. The silver thus obtained is of a fine white color. The flux usually has an intense yellow color and still contains about 10 per cent of silver. The latter may be obtained (Pharm. Centralh., xxxvi, p. 632) by mixing the flux with plenty of water and stirring occasionally to facilitate solution of the flux. The unchanged silver bromide is allowed to settle, washed by decantation, and preserved for a subsequent operation.

Sulphur Mining in Louisiana.

The Mineral Collector says: The Standard Oil Company has finally solved the great problem, on which hundreds of thousands of dollars have been spent in vain, of getting at the immense mass of sulphur which lies some hundreds of feet below the surface in Calcasieu Parish, Louisiana. For thirty-five years company after company has experimented with this deposit of sulphur, which is probably the largest in the country, and is valued at from $30,000,000 to $100,000,000. There was no doubt about the sulphur being there, but unfortunately between it and the surface lay an immense quicksand, which could not be removed, excavated or bored through. There was no way of man reaching the sulphur and getting it up. A small town, Sulphur City, has grown up in the neighborhood of the mines, at which lived the operatives engaged in trying to solve their problem. As the expenses of these employes had to be paid, and as not a pound of sulphur was obtained, the several companies organized to mine it went, one after another, into bankruptcy, until the property fell, a short time ago, into the hands of the great Standard Oil Company.

Long before the discovery of petroleum in Pennsylvania a party of hunters stumbled on a petroleum spring in Calcasieu. The Louisiana Petroleum Company was organized to mine for it, and while mining discovered that side by side with the oil was one of the most valuable deposits of nearly pure sulphur in the world. The sulphur was 400 feet below the surface and extended below 800 feet further. There was no doubt or question about this, but, unfortunately, just above the sulphur was a quicksand 160 feet thick. One effort after the other to reach the sulphur failed. The drill struck an underground well, then a gas well. After several deaths the American Sulphur Company gave up the enterprise. Then a Belgian engineer undertook the work and endeavored to neutralize the quicksand by freezing it solid and boring it through, and erected valuable refrigerating machinery for that purpose, but the quicksand would not stay frozen and that system of mining had to be abandoned.

Within the last few weeks the Standard Oil Company has got control of the property. It set about mining in a fashion the very opposite to that of the Belgian engineer. Instead of using freezing as the means of getting at the sulphur, it is trying heat. Superheated water is forced through ten inch pipe on the sulphur, melting it, and the liquid sulphur water is then pumped up. A little exposure to the air, so as to evaporate the water, leaves almost pure sulphur. The experiment has been a success beyond expectations.

AN IMPROVED BICYCLE BRAKE.

The illustration represents a very simple and inexpensive brake, which by a slight modification may be adapted for use as a foot brake, and which is designed not to cut or wear the material of which the tire is made. The improvement has been patented by William L. Stewart, of Wilmerding, Pa., and the illustration represents the device separately and as applied on a wheel. The brake frame is of metal, and carries two flanged rollers on which is tightly stretched a rubber band, the brake being attached to a stem which extends up the steering head. When the brake stem or rod is forced downward in the usual way, the band bears with corresponding pressure on the wheel tire. The inventor has also provided a construction by which one of the rollers carrying the band is adjustable, and may be moved outwardly, if desired, to increase the tension on the band.

STEWART'S BICYCLE BRAKE.

Incubation of Diseases.

According to investigations made by the Clinical Society, London, the period of incubation for diphtheria does not, as a rule, exceed four days, and is more often two, though it may also extend to five, six or seven; the infection may take place any time in the course of the disease, and mild cases may spread it. In the case of typhoid fever, this may vary within wide limits, twelve to fourteen days, but not infrequently less, and, as the disease is usually introduced into the system by food and drink, it is not carried from one person to another, but several may get it from the same source, contaminated water and milk being the usual causes. Epidemic influenza, or "grippe," has for its incubation period a few hours to three or four days, generally striking suddenly and without warning, and a patient may carry infection thoughout the whole course of the disease. Mumps have an incubation period of from one to two weeks and the chances of infection diminish daily. In the case of measles, the period is usually short, being counted from the date of the eruption, which decides the disease German measles have a long incubation period, and the infectivity diminishes in a day or two after the disappearance of the rash.

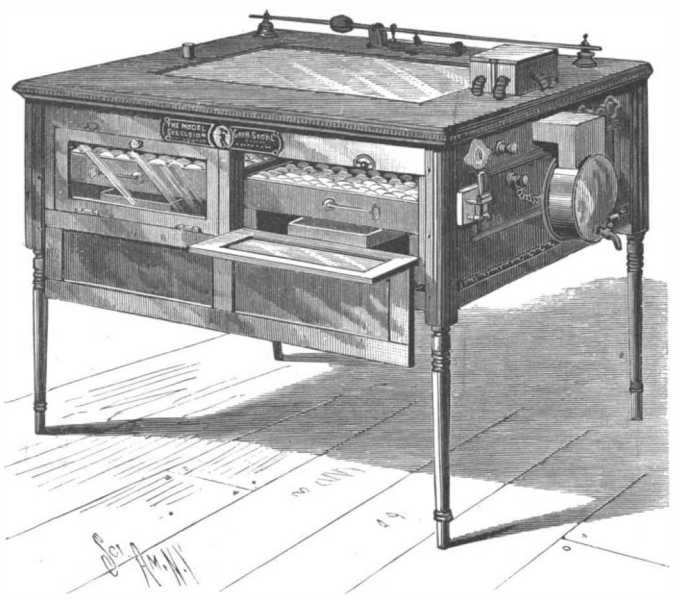
A Substitute for Gold.

A French journal describes a new and promising substitute for gold. It is produced by alloying ninety-four parts of copper with six of antimony, the copper being first melted and the antimony afterward added; to this a quantity of magnesium carbonate is added to increase its specific gravity. The alloy is capable of being drawn out, wrought, and soldered just as gold is, and is said to take and retain as fine a polish as gold. Its cost is a shilling a pound.

AN ELECTRIC INCUBATOR.

A successful manufacturer of incubators, Mr. George H. Stahl, of Quincy, Illinois, has recently placed on the market an incubator which is heated and regulated by electricity. In this incubator, which is shown in the accompanying illustration, it is said that the temperature can be adjusted to be held for weeks within a fraction of a degree of the desired point. The incubator casing has the usual double walls inclosing a filling of mineral wool, and the heat is supplied from the water tank at the top, the heating and setting up of a circulation in the water being effected through a small connected reservoir at one side. In the old style incubators the heating of the water was effected by a lamp, there being a lamp regulator controlling the flame, and a valve regulator acted upon by the heat of the water before entering the tank, while both regulators were actuated by an improved thermostat.

In the electric incubator, or "Electric Hen," as it is called, the water is heated by a resistance box, the current through which can be regulated with extreme nicety. The same manufacturer is now also building an incubator with a combination heater in which oil, gas or electricity may be used.



STAHL'S EXCELSIOR ELECTRIC INCUBATOR.

A New Car Fender.

The invention of Mr. Wm. B. Altick, of Lancaster, Pa., is so arranged that the instant the front padded bar strikes a person, an inside gum roller connected with the safety netting drops automatically on the track, thus rendering it impossible for the object struck to pass under the fender. If a person when struck should fail to fall into the netting, and fall in front, the additional pressure of the moving car against the body would cause the front cushioned bar to drop also, and would push the body along the track until the car was stopped. The person might be bruised or otherwise injured, but the danger of being crushed under the wheels would be obviated.

A POLE RAILWAY.

We give a picture, from Black and White, of a picnic party celebrating the opening of a pole railway in the province of Nova Scotia. It is a novel line, thirteen miles in length, and is the third of its kind in the province. For the most part it is utilized in bringing the deposits of silica found in the lakes down the mountains to shipping ports. The way is of spruce poles. The engine has sufficient power to draw four empty cars up the heavy grade of the railway. By taxing the motor to its utmost, and by a liberal use of sand on the rails, eighty excursionists were taken up the incline on the occasion represented.

The pole railway is probably the most economical form of steam roadway that has been produced. It is of American origin and has been in vogue in different parts of the country for the past quarter of a century.

It is especially adapted for use in forest regions, where lumbering is the principal industry.

A first class, substantial road built of poles will cost anywhere from seventy-five to two hundred and fifty dollars per mile, according to local circumstances. The expense, of course, is greater when the road has to be carried across ravines, as indicated in our engraving. The poles employed for rails should not be less than nine inches in diameter at the smaller end, and should consist as far as possible of the heart, or they will decay before they wear out.

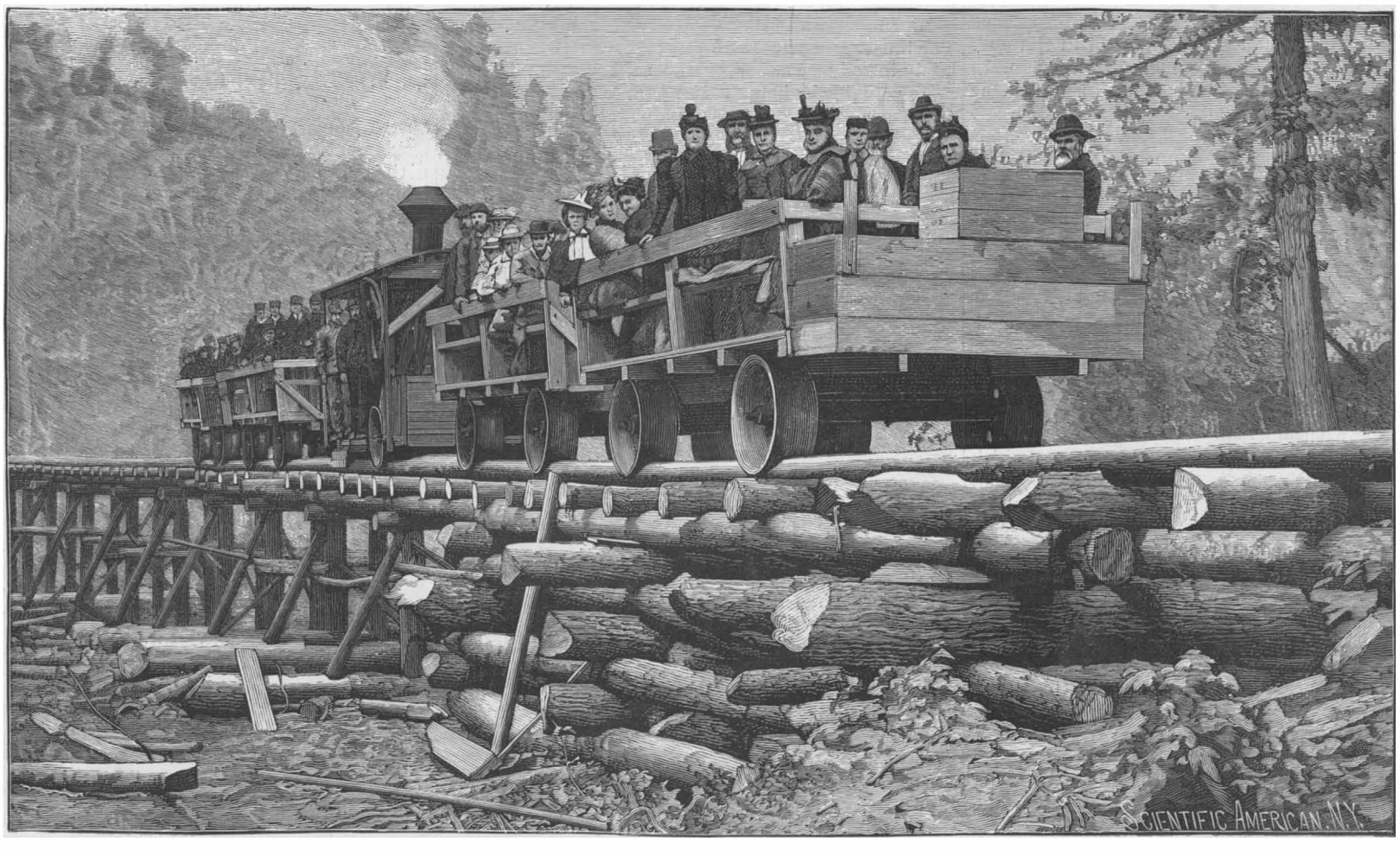
In the best roads, a bed is hollowed out in the butt end of the pole to receive the small end of the one adjoining, so as to make a secure junction. The bed is made about nine inches in length and deep enough to permit the smaller end to come up flush with the larger. The poles are simply laid on top of the ground, except when the surface is very uneven, dirt thrown on each side and trampled down to form a solid bed. After they are in place, they are slightly trimmed down with an adz. When a crook of any kind occurs in the poles, it is of course turned down in laying the track. No cross ties are necessary, as the locomotives and cars are so constructed that they exert no lateral pressure. After a few trains have passed over the road there is no fear of the poles becoming displaced. Curves are made up of a succession of short poles, care being taken that the joints come opposite to each other. The switching is readily accomplished in the ordinary way. Where heavy grades are encountered, it is the practice in some localities to place the locomotive in the middle of the train, and at the particularly steep grades to cut away half the train, push up the other half, uncouple, and return for the remaining cars. In this manner, trains of six loaded cars have been taken over grades of 700 feet to the mile with the use of only one locomotive. The wheels of the cars and locomotives have very broad treads deeply grooved, so as to fit the curvature of the poles.

The Invisible Spectrum.

It is known to all students of science that the band of colored light produced by a prism, through which sunlight is passing, appears to stop with dark red rays one way and with deep violet rays in the opposite direction. Much interest has been awakened by attempted study of this color band thought of as going below the visible red end and above the ultra violet. In a recent lecture before the Royal Institution, Dr. William Huggins spoke of these points and the methods of study of them now in use, as follows:

"Beyond the violet end of the spectrum there is a whole gamut of invisible rays, which only reveal themselves by their effect in promoting chemical action. Similarly, beyond the other end of the visible scale—the deep red—there is a gamut of invisible or dark rays, which are only perceived by their heating effects. Some idea of the importance of the 'ultra red' may be gathered from the fact that it has been traced to a distance nearly ten times as long as the whole range of the visible or light-giving region of the spectrum. To learn the character of these mysterious dark rays, then, it is clearly necessary for science to fit itself with some new sort of eyes that can see what ordinary eyes cannot—namely, heat rays and chemical rays. The photographic plate has answered admirably as an eye for the chemical rays, and brought out some wonderful facts. But with the invisible heat rays the problem was more difficult. Something in the nature of an extremely delicate thermometer is here required, which will pick out all the fine absorption lines as colder spots in the spectrum. The beautiful instrument known as the bolometer has recently been used by Professor Langley in feeling for these absorption lines, which, being regions from which the rays are stopped out, are, of course, colder than the remainder of the spectrum. The bolometer, like all the finest applications of science, is an extremely simple thing. It is a strip of fine wire, through which a feeble current of electricity is always flowing. This wire is slowly passed along the invisible gamut of the spectrum, and as soon as it comes to one of the absorption lines the spot is shown by a minute fall of temperature in the wire. This has an instantaneous effect on the flow of the electrical current. More current will pass through a cool wire than a warmer one, and the alteration is promptly shown by a delicate mirror galvanometer, which flashes its mimic signals onto a slowly revolving photographic ribbon. In this way Professor Langley has been able to pick out and locate hundreds of dark absorption lines in the great invisible spectrum which lies beyond the red. Not only is the absorption of rays by the solar atmosphere shown by this method, but the absorption lines of the earth's atmosphere are equally apparent. Dr. Huggins anticipates that the meteorologist will soon be applying the system to weather forecasts."

NEARLY all the glass eyes used in the world are made in Thuringia, Germany.



OPENING OF A POLE RAILWAY IN NOVA SCOTIA.

The Rewards of Philosophy.

Herbert Spencer's first important work, "Social Statics," was published in 1850, when he was just thirty. The great work of his life—the "System of Synthetic Philosophy"—was taken up in earnest ten years later.

The sacrifices involved in the preparation and production of the gigantic work thus heralded to the world were little short of heroic. Those who know Mr. Spencer by his books alone may have thought of him merely as devoting himself to philosophy out of the abundance of his material wealth and comfort. The truth is far otherwise. No man ever lived a more ascetic life or denied himself more for the sake of the task he had undertaken for humanity. In his evidence given before the Commission on Copyright he tells us in plain words, though in the most severely impersonal and abstract manner, the story of his hard and noble fight during the unrecognized days of his early manhood. Not a fight for bread, not a fight for fame, remember, but a fight for truth. For his first book, "Social Statics," in 1850, he could not find a publisher willing to take any risk; so he was obliged to print it at his own cost and sell it on commission. The edition consisted of only seven hundred and fifty copies; and it took no less than fourteen years to sell. Such are the rewards of serious thought in our generation! Five years later he printed the original form of the "Principles of Psychology." Again no publisher would undertake the risk, and he published on commission. Once more 750 copies were printed and the sale was very slow. "I gave away a considerable number," says Mr. Spencer pathetically, "and the remainder sold in twelve and a half years." During all that time, we may conclude from the sequel, he not only made nothing out of those two important and valuable books, but was actually kept out of pocket for his capital sunk in them.

"Before the initial volume, 'First Principles,' was finished," he observes, "I found myself still losing. During the issue of the second volume, the 'Principles of Biology,' I was still losing. In the middle of the third volume I was losing so much that I found I was frittering away all I possessed. I went back upon my accounts, and discovered that in the course of fifteen years I had lost nearly £1,200—adding interest, more than £1,200. As I was evidently going on ruining myself, I issued to the subscribers a notice of cessation."

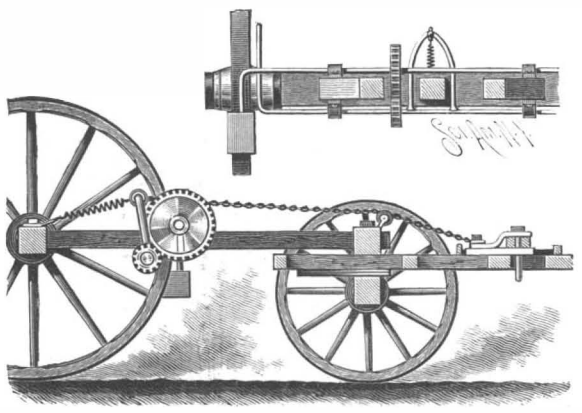
He had been living, meanwhile, in "the most economical way possible;" in spite of which he found he had trenched to that large extent on his very small capital. Spartan fare had not sufficed to make his experiment successful. Nevertheless, he continued to publish, as he himself bravely phrases it, "I may say by accident." Twice before in the course of those fifteen weary years he had been able to persevere, in spite of losses, by bequests of money. On this third occasion, just as he was on the very point of discontinuing the production of his great work, property which he inherited came to him in the nick of time to prevent such a catastrophe. Any other man in the world would have invested his money and fought shy in future of the siren of philosophy. Not so Mr. Spencer. To him life is thought. He went courageously on with his forlorn hope in publishing, and it is some consolation to know that he was repaid in the end, though late and ill, for his single-minded devotion. In twenty-four years after he had begun to publish he had retrieved his position, and was abreast of his losses. Think of that, you men of business. Twenty-four years of hard mental work for no pay at all, and at the end of it to find yourself just where you started! Since that time, it is true, Mr. Spencer's works have brought him in, by degrees, a satisfactory revenue; but consider the pluck and determination of the man who could fight so long, in spite of poverty, against such terrible experiences.—Review of Reviews.

No Water Vapor in Mars.

As the result of observations made at the observatory on Mount Hamilton, W. W. Campbell came to the conclusion last year that no aqueous vapor is contained in the atmosphere of Mars. This, says Knowledge, is quite a different opinion from that to which Janssen was led by his observations, published in 1867, which have been recently republished in the Comptes Rendus. In 1862, Janssen discovered the spectroscopic bands caused by aqueous vapor in our earth's atmosphere, these having been previously observed by Brewster in 1833. From the 12th to the 15th of May, 1867, after having first of all made himself familiar with the bands due to aqueous vapor, he made observations on the summit of Etna. On the 13th the cold was excessive, and the quantity of vapor in the earth's atmosphere was very small—not enough to make visible the lines in the solar spectrum called group C, and still less group D. When Mars was examined, groups C and D, although feeble, were distinctly visible. It was in consequence of this observation, confirmed later at Palermo and Marseilles, that Janssen announced the presence of the vapor of water in the atmosphere of Mars.

AN AUTOMATIC VEHICLE BRAKE.

The brake shown in the illustration applied to the running gear of a wagon is automatically removed from the wheels when the vehicle is moving foward, the brake being applied when the vehicle is backed or is standing at rest. The improvement has been patented by Henry N. Davis, of Dow City, Iowa. The shaft carrying the brake shoes is journaled in bearings on the rear hounds, shown in transverse section in the small figure, and centrally on the shaft is a gear wheel meshing with a pinion journaled in bearings on the under face of the hounds, the latter shaft having a handle for use when desired, and having also a central arched portion connected by a spring with the rear axle. The tension of the spring normally turns the



DAVIS' VEHICLE BRAKE.

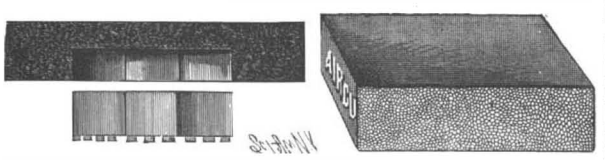
shaft to cause the pinion to act on the gear on the brake shaft to apply the brakes, which are taken off when the vehicle is started by the counteracting tension of a chain carried forward over suitable guideways to attachment to a clevis pivotally connected with the doubletree, the bracket or clevis being secured to a block sliding in the tongue of the vehicle or on the forward end of the reach. When the horses draw forward, causing a limited forward movement of the chain, the pinion and gear are rotated to remove the brake shoes from the wheels.

Suicidal Wasps.

M. Henry, a Frenchman, being curious to see the effect of benzine on a wasp, put some of it under a glass in which a wasp was imprisoned. The wasp immediately showed signs of great annoyance and anger, darting at a piece of paper which had introduced the benzine into his cell. By and by he seems to have given up the unequal contest in despair, for he lay down on his back, and bending up his abdomen, planted his sting thrice into his body, and then died. M. Henry allowed his scientific interest to overcome his humanity so far as to repeat the experiment with three wasps, only to find that the other two did likewise. He is, therefore, of opinion that wasps, under desperate circumstances, commit suicide.

"AIR CUSHION" RUBBER PRINTING STAMPS.

The very low cost of rubber stamps, and their great convenience, have made them, of late years, almost as common about a business office as pens, ink and paper. The illustrations herewith represent an improvement lately introduced whereby the rubber stamp is made more valuable by being better adapted to print plainly on uneven surfaces. It is a patented device of the R. H. Smith Manufacturing Company, of Springfield, Mass., rubber type founders and stamp manufacturers, and consists of the interposition of an air cushion, as shown in the illustration, the cushion being just elastic enough to insure, with ordinary usage, a good impression on any surface, either uneven or yielding. The cushions will not lose shape or resiliency, as they are formed by minute cells which do not



connect with one another, and the cushion is mounted on handsomely nickeled metal plates. There are no pores to fill up with ink and dirt, or compartments to puncture.

Remedy for Insect Stings.

It is well known that liquid ammonia relieves the effects of the stings of bees. A correspondent informs us that a much more effectual antidote is the mixture known as ammoniated tincture of quinine. On several occasions, when stung by bees, he found that the quinine mixture would give much quicker and greater relief than ammonia alone.

Dentistry in Japan.

In a recent letter from Japan to the New York Herald, Colonel Cockerill has this to say about the profession of dentistry in Japan:

A practicing dentist in New York City writes me to inquire whether it be true that the Japanese government is about to establish a school of practical dentistry, and is in need of American talent in the professorships. Not at all. Japan is full of dentistry, and the native dentists are flourishing. There is a dental department connected with the medical branch of the Tokyo Imperial University. There are fifty-six practicing dentists in Tokyo, and each office has from four to twelve students. These young men assist at all operations. One works the drill, another handles the syringe, another passes up the gold foil, and the division of labor is quite scientific. Many of the Japanese dentists are graduates of first-class American colleges. They are quite skillful. The Japanese are quite fond of having their front teeth filled with gold. They frequently have holes bored in good teeth in order to have them plugged and polished. They think that the exhibit of gold fillings in front teeth suggests advanced civilization. San Francisco turns out about one hundred young Japanese dentists a year (?) There is a factory in Tokyo which turns out all manner of dental instruments and dental goods, including engines and porcelain teeth. There are four American dentists in Japan, but their business has been much shorn by the rapidly multiplying native artists.

Asafetida.

This is a bad-smelling substance, oozing as a milky, opaque, fetid juice from the root of Ferula fetida. From the root stock, which in full-grown plants is sometimes six inches in diameter and more than a foot long, somewhat resembling a beet, grow numerous spreading triparted leaves of a leathery appearance and light green color. Out of their midst rises a stem of a luxuriant, herbaceous nature, sometimes as high as ten feet, carrying at the top a numerously branched compound umbel of yellow flowers, which betrays the natural order of the plant—Umbelliferae. Although the odor is so offensive to us, we are told that the people of Bokhara use the small plant as a green vegetable as we do lettuce, and relish it. The root stock, which always protrudes several inches out of the ground, is freed from small rootlets and leaves in the month of June, selecting the plants that have not yet borne flowers, and a slice of it is cut off. The wound is then covered loosely with twigs and leaves, to exclude the sunlight, which retards the process; and it is left this way for a few weeks, at which time a thick reddish or brownish gummy substance is found on the exposed part. This exudation, a hardened suppuration of a vegetable wound, is removed, put into leather bags and taken to Herat, the commercial center of Afghanistan. It is stated, on good authority, that hardly any asafetida leaves that city in a pure state, a red clay being used as an adulterant, which the pharmacists of Europe and America have to filter out when making the tincture. From Herat the asafetida goes to India, and is thence brought by the Parsee and British traders into the markets of the world.

The rose of Kashmir grows in the same ground with the Ferula fetida; they drink the same dew, feed on the same soil, and the same golden sun ripens their fruits. But while the one fills the air with fragrance and enchants the eye, the other, like an evil spirit, destroys our rapture, and calls a chilly halt to our enchantment. Thus the good and the bad live close together, not only among the plants, but also among men; and this close proximity of contrasts directs the differing thoughts of the thinker.—Merck's Report.

A Word to Mail Subscribers.

At the end of every year a great many subscriptions to the various SCIENTIFIC AMERICAN publications expire.

The bills for 1896 for the SCIENTIFIC AMERICAN, the SCIENTIFIC AMERICAN SUPPLEMENT, and the ARCHITECT'S AND BUILDER'S EDITION of the SCIENTIFIC AMERICAN are now being mailed to those whose subscriptions come to an end with the year. Responding promptly to the invitation to renew saves removing the name from our subscription books, and secures without interruption the reception of the paper by the subscriber.

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THE IRON INDUSTRIES OF BIRMINGHAM, ALA.

In a recent issue we published an article on the Iron Industry of Birmingham, Ala., in which brief mention was made of the uses to which the products of the iron furnaces of that district were applied. In continuation of the subject, we note the advancement in manufactures made at that place in the last few years.

It is now about twenty years since the then little village of Birmingham became known as the possessor of great wealth in iron and coal. The mineral and metallic deposits were found to lie in such profusion within her district, and in such close proximity, that but little expense need be incurred in their transportation to the furnace for reduction.

At some remote period there was evidently an upheaval of the earth where now stands the city of Birmingham, with a fracturing of the various strata of the earth's crust. This upheaval and the subsequent deposit of soil formed the beautiful valley with the elevated ridges on either side running in a northeast and southwest direction. By this grand process of nature the formerly deeply buried strata of bituminous coal and red iron ore were rendered accessible. For years the ridge upon the south side of this valley has been known as "Red Mountain," without any thought of great value being attached to it. At the close of the war, in 1865, every gift of nature was examined and utilized, and enterprising men, seeing evidences of such wealth cropping out of the earth, took advantage of the opportunity, and, by experiments, ascertained the richness of the ore. Further development showed the mine to be practically inexhaustible, and accompanied with overlying beds of coal.

In our illustrations we show the works in which this ore is made into fine merchantable pig iron. The iron of the Birmingham district is unexcelled for the manufacture of puddled bar iron and for purposes where it is essential that its working qualities in the finished castings should be characterized by that peculiar softness in turning, boring, filing and drilling that is so pleasing to the artisan and satisfactory in the final product. The demands of those who work in iron are varied; that which is most satisfactory to certain manufacturers will not do for a different class. Soft iron is useful for many purposes, but there are many important and extensive fields in which the soft iron of the South has found no place; notably in the use of iron for the manufacture of Bessemer steel and malleable iron. Peculiar qualities are required in these two very important fields of iron consumption, and it has been questioned if the Birmingham iron could come into use for these purposes.

The only use of pig iron prior to the invention of Bessemer, aside from that of making castings, was for the manufacture of wrought iron, for which purpose the softer grades of pig iron were specially adapted, also for other purposes in which the presence of such disturbing elements as sulphur, silicon, and phosphorus did not prove injurious. The process discovered by Bessemer of converting pig iron directly into steel was found to depend for success upon the almost entire absence of these disturbing elements; the value of an iron, for the Bessemer process, is carefully determined by chemists. The presence of 0·1 per cent of phosphorus, or 2 per cent of silicon, unfits it for making Bessemer steel, although it would still be serviceable for puddling into wrought iron and converting into blistered steel.

Until recently the irons made from the red ores of Birmingham contained phosphorus and silicon in quantity sufficient to prevent their use in the Bessemer process, as analysis showed the presence of 0·8 per cent of phosphorus. The subject of elimination of phosphorus from iron had been the study of chemists until 1878, when it was found that phosphorus would unite with lime and float as a slag consisting of phosphate of lime. By virtue of this important discovery it has been possible to convert millions of tons of iron into steel, this being known as the "basic" process, a process in which the converter is lined with magnesite bricks, with quantities of free lime, oxygen being provided by the introduction of scrap iron or ground limonite (brown ore). This process is used in the "open hearth" system, perfected by Gilchrist and Thomas.

The Birmingham irons, however, were unfitted for this purpose, as the amount of phosphorus was so great as to necessitate such an amount of lime to take up the phosphorus as to be destructive to the acid lining of the converter, and the amount of silicon was too great to admit of treatment in either a basic Bessemer converter or an open hearth furnace.

It has, therefore, been found that the Southern irons produced in the old way were unfitted for Bessemer or open hearth processes.

What has proved a failure, however, with chemistry as the teacher has been learned—so we are credibly informed—by the union of chemistry with skillful and correct management of the heats and of the burdening of the ore over the coke.

The "Alice" furnace of the Tennessee Coal and Iron Company, in Birmingham, an interior view of which we show on our front page, has, by careful management, been successful in producing pig iron from the ores of the Birmingham district, showing a percentage of considerably less than 0·1 per cent of phosphorus and 0·5 per cent of silicon. Tests of the iron have so far satisfied the chemists of such well-known steel producers as the Carnegies, Jones & Laughlin, Park Brothers, and others that already—as we are informed—thousands of tons of this pig iron have been ordered by them from Birmingham furnaces. The importance of these results will be appreciated when the cheapness with which Southern iron can be produced is considered.

Our illustrations show the casting flow of the "Alice" furnace, and a perspective and sectional view of one of the moulds. It will be seen that the pigs are cast in iron moulds instead of sand moulds as usual. One of the main objects in this method is to prevent the crusting of the exterior surface of the pig with extra silica, which would deteriorate the iron in subsequent melting.

A Submerged Forest.

Many years ago, even so far back that the traditions of the oldest Siwash extend not thereto, there was some vast upheaval of Mother Earth on the shores of Lake Samamish that sent a portion of the Newcastle hills sliding down into the lake, with its tall evergreen forest intact, and there it is to this day. About this time of the year the waters of the lake are at their lowest, and then the tops of the tallest of these big submerged trees are out of the water, but never more than ten or twelve inches.

Unfortunately for the curiosity seeker and traveling public generally the submerged forest is on the opposite side of the lake from the railroad and the station of Monohon, and very few people ever see the phenomenon unless they take the time and pains necessary to reach it.

Sam Coombs, the pioneer, is very enthusiastic concerning its beauties and mystery. He talks Chinook fluently, but with all his quizzing of the red-skinned inhabitants he has never learned anything that will throw any light on the history of the forest under water. The waters of the lake are very deep, and the bluffs back of the beach very precipitous, so that the only explanation of the freak is that either by an earthquake or some other means a great slide has been started in early times, and it went down as a mass until it found lodgment at the bottom of the lake. At this time one can see down into the glassy, mirror-like depths of the lake for thirty feet or more. Near the banks the forest trees are interlaced at various angles and in confusion, but further out in the deep water they stand straight, erect, and limbless and barkless, 100 feet tall. They are not petrified in the sense of being turned to stone, but they are preserved and appear to have stood there for ages. They are three feet through, some of them, and so firm in texture as to be scarcely affected by a knife blade. The great slide extended for some distance, and it would now be a dangerous piece of work for a steamer to attempt passage over the tops of those tall trees. Even now the water along shore is very deep, and a ten foot pole would sink perpendicularly out of sight ten feet from the shore line.

All over this country are found strata of blue clay, which in the winter season are very treacherous, and given the least bit of opportunity will slide away, carrying everything above with them. This is the theory of the submerged forest of Lake Samamish. It probably was growing above one of these blue earth strata, and heavy rains, or probably an earthquake, set it moving. The quantity of earth carried down was so great that the positions of the trees on the portion carried away were little affected. It is hardly to be believed that the earth suddenly sank down at this point and became a portion of the beautiful lake.

Few such places exist. There is a place in the famous Tumwater Canon, near Leavenworth, which is in some respects similar. At some early time a portion of the great mountain side came rushing down and buried itself at the bottom of the canon. Now there is a considerable lake, and in the center stand tall, limbless trees, different in species from those growing along the canon.

At Green Lake, near Georgetown, Col.—a lake which is 10,000 feet above sea level—is a submerged forest of pine trees, some hundred feet tall, but not so numerous as in Lake Samamish. This same theory explains their presence as given above.—Seattle Times.

The Discovery of Argon.

Lord Rayleigh and Prof. Wm. Ramsay called at the United States Embassy, in London, recently, when Mr. James R. Roosevelt, first secretary, handed to them a check for $10,000, which had been granted by the Smithsonian Institution, at Washington, as the first Hodgkins prize, for their memorandum on "Argon, a new constituency of the atmosphere," embodying a most important discovery in connection with atmospheric air.

Correspondence.

Sylvanus Sawyer.

To the Editor of the SCIENTIFIC AMERICAN:

My attention has been called to an article in a recent number of the SCIENTIFIC AMERICAN concerning the late Sylvanus Sawyer.

No mention is made of his connection with his brothers Joseph and Addison.

While I would not detract from his prominence as an inventor, no account can properly be given of him that does not include them, one or both of whom were always associated with him in business in the old "gun" days, and were also inventors in those lines. Addison invented a combination shell used in the late war, a combination fuse, and other ordnance articles, upon which he obtained patents.

He also invented the "Sawyer canister," which was adopted by the government, and for which he was awarded $25,000.

Concerning the rattan business, Addison's invention, the "tubular spurred cutter" for utilizing rattan pith, patented by him in 1854, revolutionized the rattan industry of the world.

They were three remarkable men, sprung from a race of ingenious mechanics.

Granting the honor due his brothers will not lower the rank of Sylvanus Sawyer among the inventors of his time.

Allow me to make a correction. Sylvanus Sawyer died at his home in Fitchburg, Mass., not "Templeton," where he had long been identified; also that he was the son of John and Lucy (Balcom) Sawyer, instead of "Malcom J." MARY E. SAWYER.

Boston, Mass., November 25, 1895.

Electric Power in New York City.

The Electrical Engineer says that on January 1, 1895, the Edison Electric Illuminating Company had connected 7,615 horse power of electric motors, but at the end of October it had no less than 11,263 horse power, an increase of 3,648 horse power in the short period of ten months. The horse power capacity thus connected includes, it would seem, a great many of the fan motors, but not all, as it is becoming a common practice for people to plug the small motors into lamp sockets without fuss or notice, and, of course, these do not appear on the returns.

The company has 251,487 incandescent lamps connected and 3,280 arcs. This would figure out in the neighborhood of 25,000 horse power, so that one-third of the company's total connected capacity is now represented by motors. This is a notable showing for power uses of current. We estimated that whereas in the census year, 1890, the motors averaged about 1 horse power each, they might now reach 5 horse power. Mr. Lieb informs us that the motors average between 5 and 10 horse power, and that one of the motors in regular service on the mains has a rated capacity of 40 horse power. It is evident that the stationary motor industry must be increasing at a rapid rate, for these figures, large as they are, take no account of other stations than the Edison, and do not include isolated plants, many of which are heavily loaded with motor duty in running pumps, elevators, ventilators, etc.

The Preparation of Wool for Underclothing.

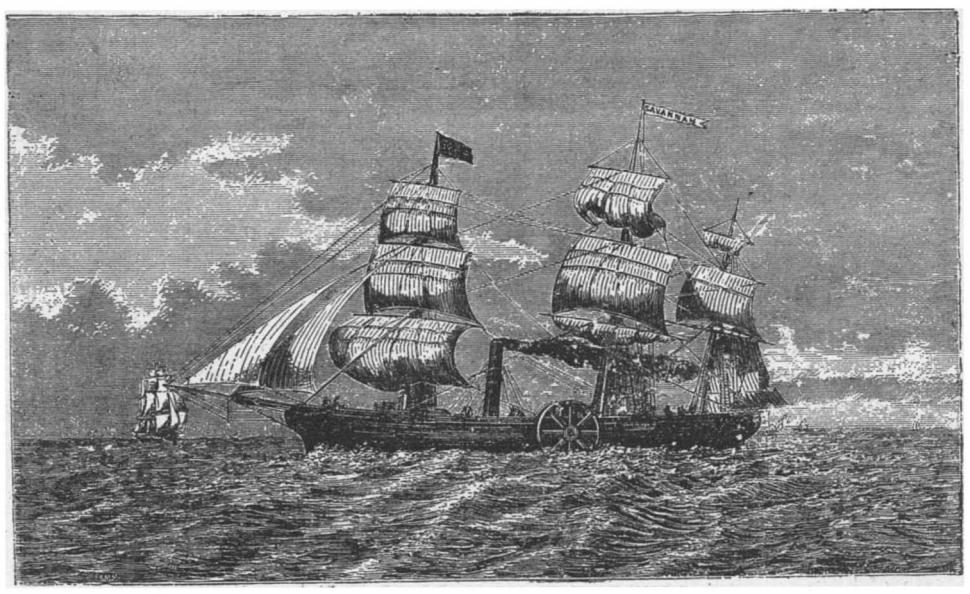
The method of preparation consists in soaking the pure, unsulphured, undyed wool in the extract described below.

Bark, taken from the stem and roots of the Daphne mezereum, a tree growing in the northern regions of Europe, after being dried in the air for rather less than a year, is cut up finely and placed in 40 per cent of spirits of wine and 60 per cent of water, for six days, in the proportion of one part of bark to four parts of the mixture. In this time, the spirits of wine draws out of the bark resin, oil, daphnine, wax, etc., and a brownish mass results. After straining it off from the macerated bark, the extract is put into a copper vessel of such a shape and size as is suitable and convenient, then heated to 35° Reaumur, and the wool in a completely loose condition, so that the extract may reach and act on all the fibers, is placed therein, and kept for three hours at this temperature, whereby it is impregnated with the alcoholized extract. After this time, the wool is taken out of the vessel and dried on wide meshed hurdles; it can then be spun and woven.

The patentee claims that, during wear, the wool prepared by this method remains generally odorless and possesses an unsurpassable suppleness and softness, as well as a peculiar absorptive activity on the humors and perspiration of the body, which are therefore drawn to the outside of the texture, causing the body to keep dry; that the wool loses its natural harshness and the prepared material does not irritate the body, and that the single fibers become exceedingly elastic, porous, more capable of absorption and shrink no more, so that the properties beneficial to the human body are never lost, even by washing, cleaning and thorough airing of the stuff.

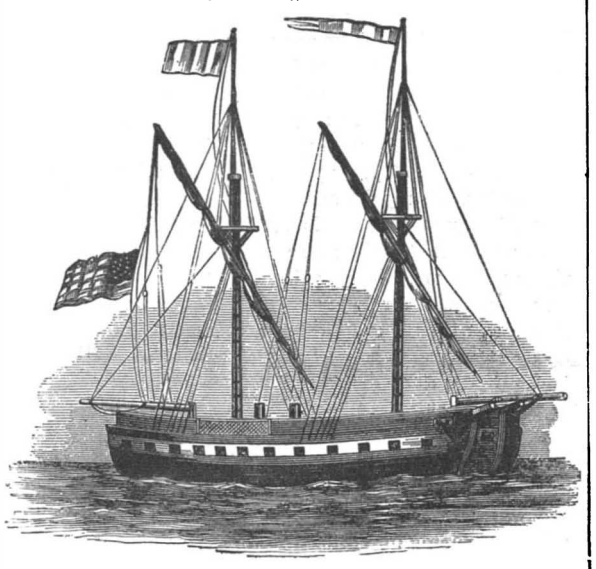
THE EARLY HISTORY OF OCEAN STEAM NAVIGATION.

Although the paddle wheel antedates the Christian era, the earliest recorded attempt to utilize steam to turn the paddle wheel was made by Blasco de Garay, in 1543. Denis Papin experimented on the Fulda at Cassel in 1707, and various other experiments were tried by Jonathan Hulls, the Count d'Auxiron and the Marquis de Jouffroy, but these experiments were of little importance when compared with those of the Americans, William Henry, of Chester County, Pa., James Rumsey, John Fitch and Robert Fulton. After studying the subject of steam navigation abroad, Fulton returned to the United States in 1806, and with Chancellor R. Livingston had a boat named the Clermont built at New York by Charles Brown. The hull was of wood and was 133 feet long, the breadth of beam was 18 feet, and depth of the hold was 7 feet, and the vessel was of 160 tons burden. The engines were built in England by Boulton & Watt; the diameter of the cylinder was 24 inches, and the piston had a 4 foot stroke. The boiler, which was made of copper, was 20 feet long, 8 feet wide and 7 feet high, and was only adapted for low pressures. The engine drove paddle wheels situated amidships; these wheels were 15 feet in diameter, and there were 8 buckets to each wheel, 4 feet long, and the dip was 2 feet.



THE SAVANNAH.

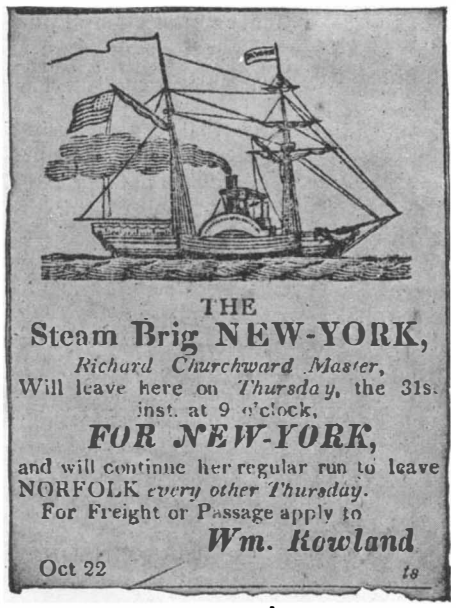
The Clermont may be regarded as the world's first successful steamboat. The first trip was made on August 7, 1807, from New York to Albany. Her speed nearly averaged 5 miles per hour. The next year the Clermont was enlarged, and the name of the vessel was changed to the North River.



THE WAR STEAMER FULTON THE FIRST.

The first sea voyage ever made by a steam vessel was made by the Phœnix, a side wheel steamer with engines designed by Colonel John Stevens, built in 1807. The steamer could not ply on the Hudson, as Fulton and Livingston held the monopoly of the navigation of that river. The Phœnix was taken by sea around to the Delaware River. This was the first sea voyage of a steamer, and after this time the evolution of the steamboat was rapid.

The first war steamer was built at New York by Robert Fulton. During the war of 1812, when our navy was making a glorious record at sea, the subject of the defense of cities and harbors was agitated, and Fulton was called upon to design a steamship of war, which was called the Demologos, or Fulton the First. The hull, which was of wood, was constructed by Adam and Noah Brown in the Eastern District of Brooklyn. She was launched on October 29, 1814. As launched she was considerably modified from the original plans. She was 156 feet long, 20 feet deep and 56 feet broad. Instead of a small well for the paddle wheel, a long channel, 13 feet wide and 66 feet long, was provided for it. On one side of the hull was a copper boiler, 22 feet long, 8 feet deep and 12 feet wide. On the other side was the engine, with one cylinder, 48 inches in diameter and 5 feet stroke. The paddle wheel was 16 feet in diameter and 14 feet wide, giving a clearance of 6 inches from the sides of the channel. It dipped 4 feet. Her tonnage was computed at 2,475 tons—a very large vessel for that period. Her hull was designed by Samuel Humphreys, of New York, and cost $144,949. The boilers and engines were designed by C. W. Copeland. The engine cost $40,199 and the boiler $93,396. Great difficulty was experienced by the commissioners in getting men to work on her. It was war times. Many of the New York shipbuilders were gone up the lakes. Material was very difficult to supply; guns were transported by land from Philadelphia, over the "miry roads of New Jersey," as the commissioners described them. Twenty heavy cannon were thus brought to New York. As completed she was to carry thirty long 32-pounders and two Columbiad 100-pounders. In June, 1815, her engine was in a condition to be tried and on July 1 she went down New York Bay to the Narrows on her first trial trip, and on July 4 of the same year she made a 53 mile passage out on the ocean and back in 8 hours and 20 minutes. The war terminating, she was moored on the flats abreast of the navy yard in Brooklyn, where she was used as a receiving ship. On June 4, 1829, she blew up, killing and wounding a number of people.

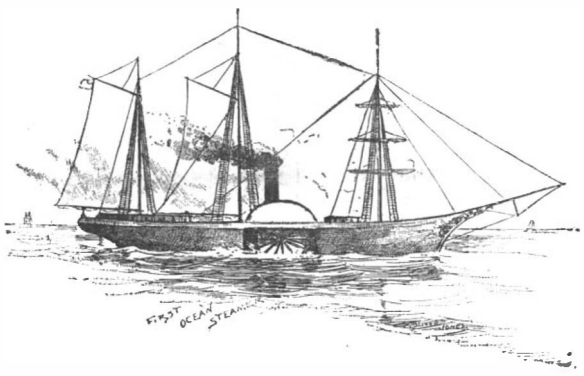


A SHIPPING ADVERTISEMENT OF 1822.

To America belongs the glory of building the pioneer transatlantic steamship. This was the steamer Savannah, which was built at Corlaers Hook on the East River, New York City. She was launched August 22, 1818.

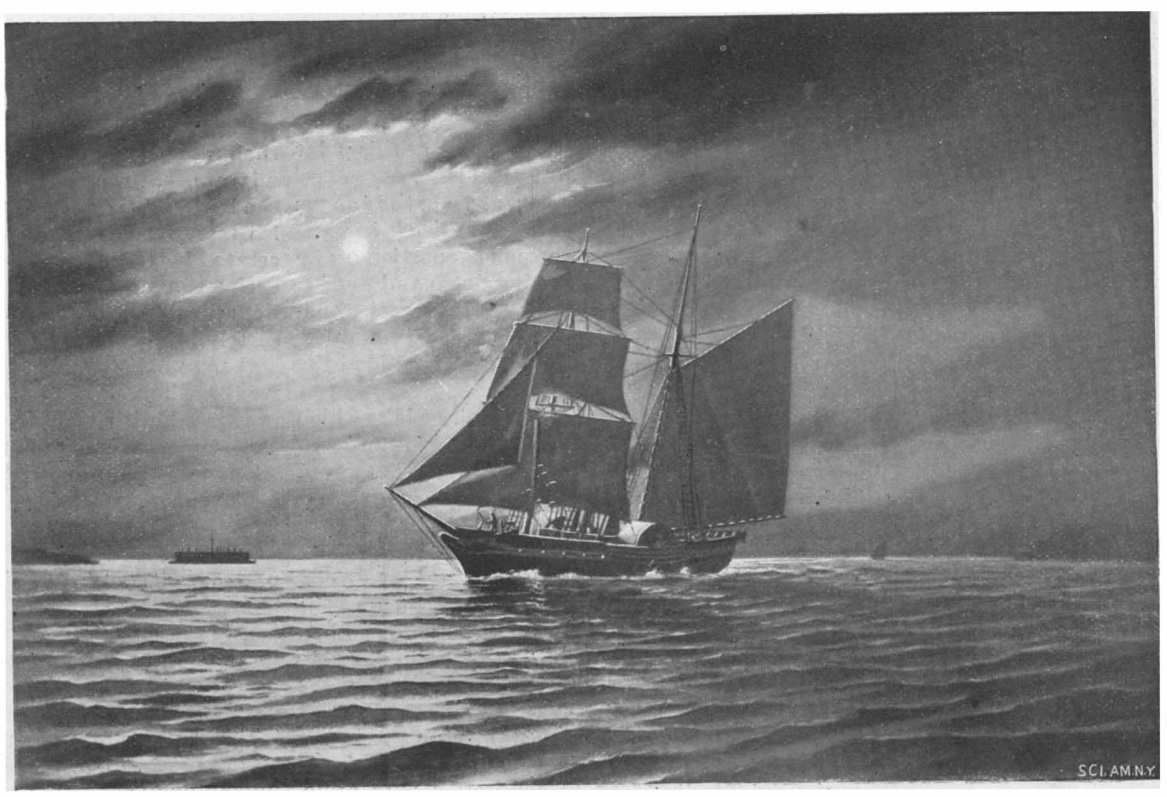
She was built by Francis Tickett for Daniel Dodd. Her engines were made in America. She was intended to be used as a sailing packet between New York and Liverpool, but was purchased before being finished by William Scarborough & Company, of Savannah, Ga., and fitted with machinery.

It is a curious fact that the paddles were so constructed as to be folded up and placed on deck in stormy weather; the wheel was inclosed in canvas supported by an iron frame. She could carry only seventy-five tons of coal and twenty-five cords of wood. Commanded by Captain Moses Rogers and navigated by Stephen Rogers, both natives of New London, Conn., the Savannah sailed from Savannah, Georgia, on the 25th day of May, 1819, bound for St. Petersburg, via Liverpool. She reached the latter port on January 25, having used steam eighteen days out of twenty-six, and thus demonstrated the feasibility of transatlantic steam navigation. The machinery was afterward taken out of the Savannah and she was turned into a sailing packet. For some time she ran between New York and Savannah and was finally wrecked on the Long Island coast. For interesting details of the first transatlantic trip from the log book see the SCIENTIFIC AMERICAN SUPPLEMENT, No. 636.



THE ROYAL WILLIAM.

The second ocean steam vessel was the steam brig New York, built at the foot of Newcastle Street, Norfolk, Va., in 1821, by William F. Hunter, ship joiner. She was of 281 tons burden and 50 horse power. Her owners were George Rowland (father of Mr. Thomas B. Rowland, through whose courtesy we are indebted for the advertisement from the Norfolk Beacon of October 28, 1822, which we reproduce), Charles N. S. Rowland, John Allmand, Captain Richard Churchward, and William F. Hunter. The motion of the machinery was steadied by a large flywheel. The trip from Norfolk to New York was made in fifty hours.



THE STEAM BRIG NEW YORK.

The engraving of the steam brig New York was made from a photograph taken from the original oil painting, which is the property of the Old Dominion Steamship Company, and is now deposited in Sailors' Snug Harbor, at Staten Island. The sailmakers' boy who helped rig the New York is still living in Norfolk, at the age of ninety-five, and states that the rough cut in the old advertisement was made by local artists

direct from the ship. Next to the Savannah and the New York comes the Royal William, which it is said was the first sea-going steamer that ever crossed the ocean, propelled all the way by steam. It was built in 1830–1831 at Quebec, Canada, and was of 1,645 tons burden and was intended as a packet ship between Quebec and Halifax. In 1833 she was sent to London. She arrived after a prosperous trip of twenty-five days; she was afterward sold to the Spanish government.

The following were her dimensions: Length of deck, 169 feet; length of keel, 159 feet; extreme breadth, 47 feet; depth of hold, 19 feet; rake of post, 2 feet; rake of stern, 13 feet; draught of water, 14 feet.

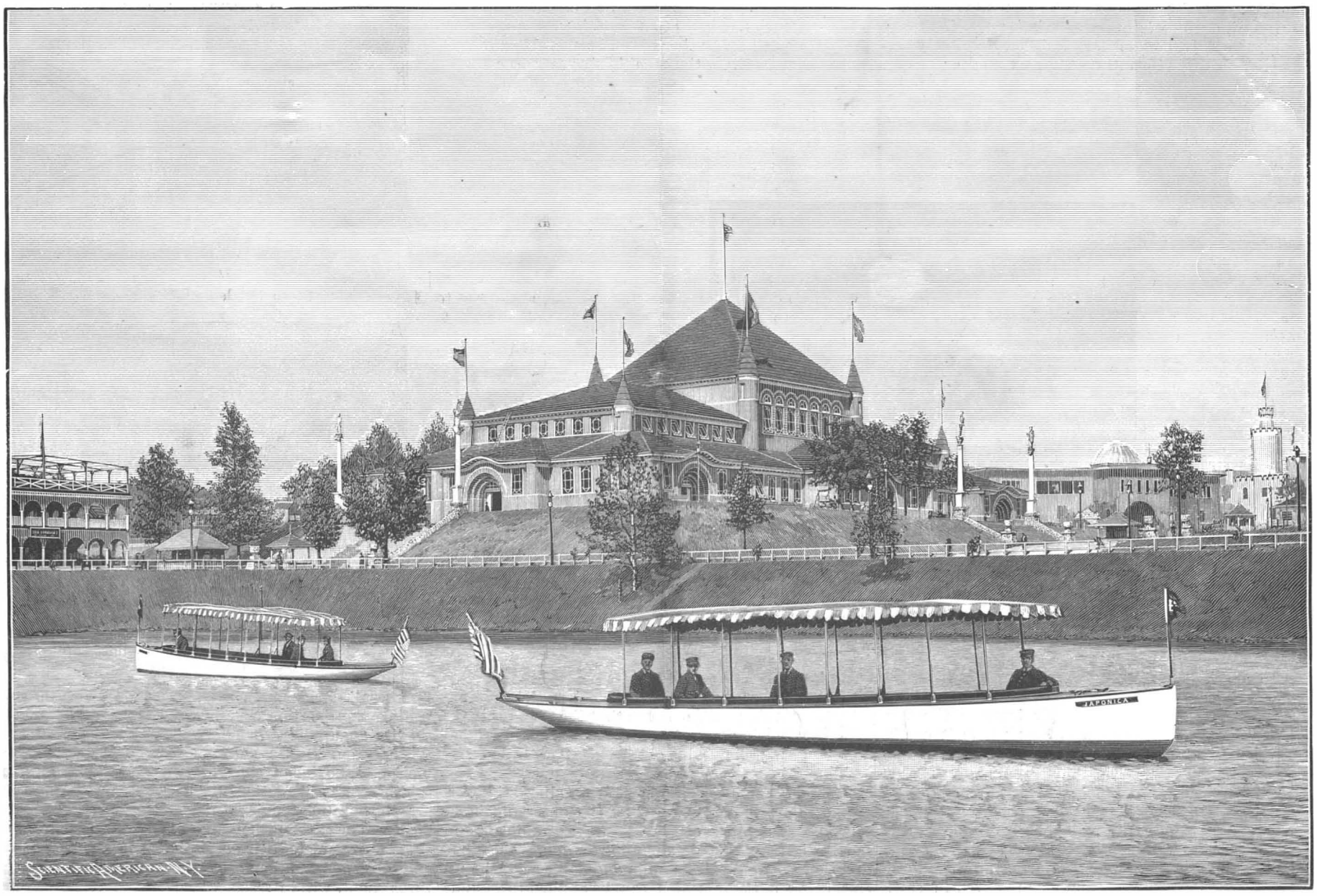
For detailed account of this vessel see SUPPLEMENT, No. 801.

THE ATLANTA EXPOSITION.

In our issue of November 30 we presented an interior view of the Fine Arts building at the Exposition grounds. We show herewith a portion of the exterior, the view being taken from a point to best bring out the details of ornamentation. The edifice, designed as a permanent structure, stands upon the highest part of the grounds between the Government and New York State buildings, and has a frontage of 245 feet, including the two side wings, one of which shows in our view as projecting beyond the main building. The depth of main structure is 100 feet and the height of the center façade is 50 feet. The building is classical in design, with a portico roof supported by a single row of Corinthian columns. A highly ornamented frieze enriches an otherwise plain but beautifully proportioned front, and the broad steps are flanked on either side by life-sized figures of lions in bronze.

We also show in another view the Agricultural building, as seen from the bank across the Clara Meer. This structure is 304 feet long, 150 feet wide, and is 110 feet high. The contributions from the various States of the South, of the soil products of farm and plantation, is of exceeding interest. All of the

THE ATLANTA EXPOSITION—THE FINE ARTS BUILDING.



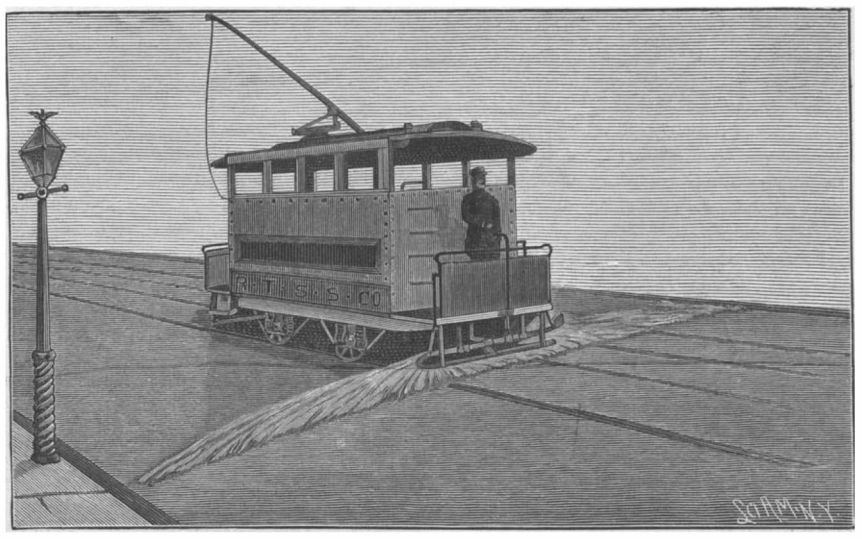
THE ATLANTA EXPOSITION—THE AGRICULTURAL BUILDING.

various grades of cotton are shown, exhibiting their merits for color, fineness, and length of staple. Sugar and molasses in all forms, from the raw cane to the finished sweets. Fruits and grains are shown in great varieties. Specimens of plums and that wonderful Southern grape, the Scuppernong, are especially tempting. It is worthy to note, also, that the exhibit of wines from the Southern grapes denotes a near-by source for this great market that may cause trepidation in the distant Californias.

The arrangement of the exhibits displays artistic as well as convenient location for the visitor. To the Northern man or woman this building and its interior presents great attraction.

THE ELECTRIC RAILWAY STREET SPRINKLER.

Mr. L. W. Campbell is the inventor and patentee of a new design in railway street sprinklers. The accompanying illustration shows its appearance when in use. It is a combined track and street sprinkler, and the first effort within our knowledge to combine the two ideas. It is so constructed that it will, at the pleasure of the motorman, sprinkle a single or double track alone, omitting the sides, or it will sprinkle one or both sides, including the track, if desired. It will sprinkle a street of any reasonable width, say a street so narrow as to barely allow the car to pass, to a street one hundred feet wide, without any change in the structure of the machine. The Car says the Rapid Transit Street Sprinkler Company, of Waco, Tex., are the makers.



THE ELECTRIC RAILWAY STREET SPRINKLER.

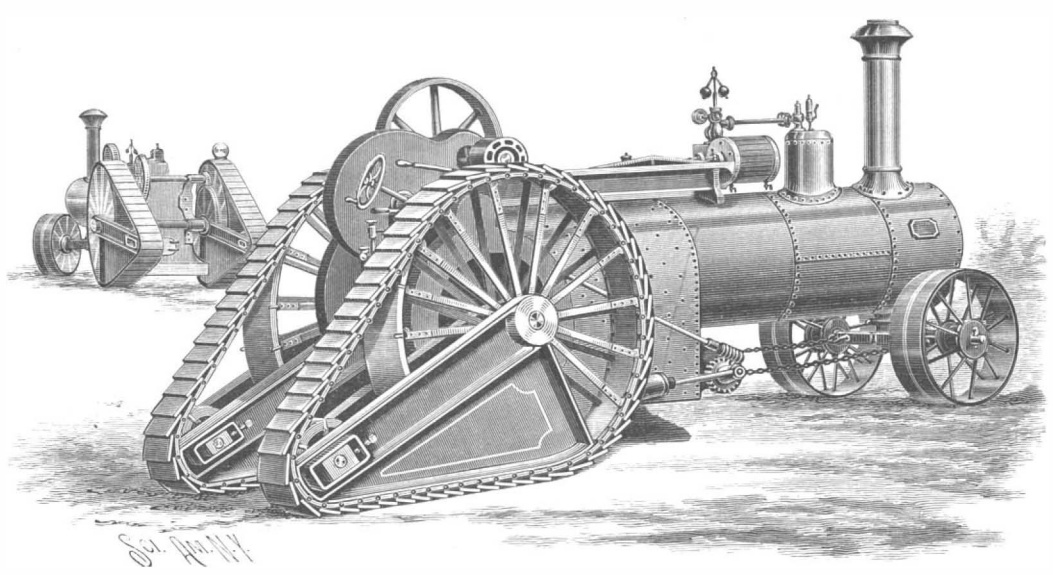
Why Propeller Shafts Break.

It is getting to be pretty well understood that the frequent breaking of propeller shafts is not due to the defective material of the shafts themselves so much as to the excessive strains to which they are subjected, owing to the working and straining of the hull of the ship in a seaway. The Railway Engineering and Mechanic states that careful measurements taken on a steamer in heavy weather showed that the propeller shaft was at times sprung out of line 1¼ inches in a length of 112 feet. Measurements on deck showed the same amount of deflection. The ship was stiffened, and the shafting gave no further trouble.

INGLETON'S IMPROVED TRACTION ENGINE.

Many unsuccessful attempts have been made to design a practical automatic track for use on traction engines, whereby the latter could be made to serve all the requirements of the farmer, but, apart from their being generally too cumbersome, it has frequently been found difficult to turn the engine around or make a curve within a reasonable space.

The illustration represents an improved track-laying device, which has been patented by Edward Ingleton, of the Ingleton Steam Plow Company, of Pottstown, Pa., for use on traction engines. The illustration shows the appliance both in and out of operation. The track is pivoted to the main axle of the engine, and is so fitted that it can rise or fall without altering its length. It is connected by a rod or pitman to a crank keyed on each end of the steerage roller, so that the vertical movements of the track are governed automatically by the steering of the engine and the lateral movement of the front end of the latter. The moment the engine is steered from its straight course the cranks on the steering roller come off the dead center, and allow the back end of the track to rise in the same proportion as the front, or steering axle, has turned. This brings the center of the weight back under the main axle, and the engine can swivel around in as short a space, and without straining the track, as if the track were not there. The appliance is designed to greatly increase the usefulness of the traction engine, from which it can be detached in a few minutes, as desired. The steering and adjusting of the track is done by Ingleton's steam steerage, not shown in the engraving. When not required in use, the cranks on the steering roller are reversed and the track is then held clear of the road.



INGLETON'S IMPROVED TRACTION ENGINE.

The importance of being able to use a steam engine in all the laborious work of the farm, and thereby reduce the number of horses and men required in cultivation, with the attendant cost of feeding through many months when in idleness, cannot be overestimated. If the thousands of horse power available in traction engines that are now idle could be successfully harnessed, it would prove a most powerful auxiliary to the farmer, as such engine, fitted with a proper track, according to the design of the inventor, should be made to plow; then, by means of a suitable machine, to seed and harrow, run the self-binder at harvest, and, lastly, do the thrashing.

Progress of the Panama Canal.

It was announced recently that the French company in charge of the work on the Panama Canal is now collecting 2,000 more men from Jamaica and other West Indian islands to add to the 1,800 now at work, and that it is intended eventually to increase the force to 6,000 men. The New York Evening Post declared that it had received information which it considered trustworthy that the money to finish the work on the present plan has all been furnished, and that nothing can prevent the opening of the canal at the appointed time, except accidents and obstacles not now anticipated. The managers even expect that the work will be completed in six years. This is quite in line with the report made by Sir Henry Tyler, the late president of the Grand Trunk Railway, who has been visiting Panama. He says that it is proposed to construct two large dams, one across the Upper Chagres River and one on the Lower Chagres River. Two lakes will thus be formed, the upper one supplying water to the higher portion of the canal, while the lower one will be mainly used to furnish water for the navigation of the lower part. Ten locks will be built, enabling the canal to reach a height of 170 feet above the sea level. Sir Henry holds that there is no insuperable difficulty in the completion of the canal in six years, at a cost of $100,000,000 by utilizing the work already done for a distance of sixteen miles from Colon and four miles from Panama. On the other hand, Mr. Colquhoun, the correspondent of the London Times, who has recently inspected the route, estimates that, even supposing one-third of the work to have been concluded, it will cost more than $200,000,000 to complete the entire undertaking. He declares that the Chagres River and the Culebra cut of the present Panama Canal plans are insurmountable obstacles.—The Outlook.

PATENTED artificial skin is now produced in Germany. It is made by removing the outer and inner mucous membranes of the intestines of animals and partly digesting them in a pepsin solution. The fibers are then treated with tannin and gallic acid, the result being a tissue which can be applied to wounds like a natural skin, and is entirely absorbed in the process of healing.

An Improved Motor for Sewing Machines.

Sewing machines adapted for useful general work are invariably driven by a treadle to which either one or both of the feet may be applied. The ordinary treadle answers well for the stitching of exceptionally stout materials and for the purposes of various machines driven with the foot by men such as turners or printers, but for average sewing machine work it has the drawback of requiring more effort than is necessary. This extra fatigue is a serious consideration in the case of females employed all day long at the machine, but an ingenious modification of the ordinary treadle has now been introduced by which the labor of the worker will be greatly economized without any sacrifice of efficiency. As is well known, the ordinary treadle is horizontal when at rest and has to be forcibly depressed by the foot in order to turn a flywheel by means of a crank. In the new system the flywheel and crank are retained, but the horizontal treadle is replaced by a vertical one which is hinged to the under side of the table on which the machine rests, and hangs down almost to the floor, where it ends in a horizontal platform for the foot. The worker's foot is not moved up and down to drive the machine by pressing the treadle, but produces the same effect with less labor by a gentle swinging of the foot backward and forward. The muscles chiefly employed are the flexors and extensors of the knee joint, and the weight of the foot and leg is, of course, supported by the platform on which the foot rests. An important advantage is that the continual movement of the thigh, inevitable under the present system, is so diminished as to be hardly perceptible. The "Hygienic Motor" is the appropriate name of the new invention; its principle is sound and the details are extremely simple. The ordinary treadle is employed to most advantage when the flywheel is comparatively heavy and the operative stands at the machine; but for seamstresses who sit all day long at the machine the to-and-fro movement of the foot is less exhausting than the alternate upward and downward movement which has hitherto been required. The new system can be readily adapted to any of the existing kinds of sewing machine.

The Absolute Dimensions of Stellar Systems.

In a recent number of the Astronomische Nachrichten (No. 3314) Dr. T. J. J. See has a very important paper on the "theory of the determination, by means of a single spectroscopic observation, of the absolute dimensions, masses and parallaxes of stellar systems whose orbits are known from micrometrical measurement; with a rigorous method for testing the universality of the law of gravitation." The ordinary determination of the orbit of a double star furnishes us no idea as to its distance from us, and hence no measure of the absolute dimensions or masses of the system. The measures of the parallax upon which we depend for our estimates of distance are extremely difficult and the results are in most cases unsatisfactory. The measures are taken from neighboring faint stars, which are assumed to be so much more distant that their annual displacement will be imperceptible. This assumption is not always safe and the resulting parallaxes can only be regarded as relative.

Dr. See shows how, by a very simple and elegant method, we may determine the absolute dimensions of the orbits of bright rapidly revolving binary stars, by single spectroscopic measures of the motions in the line of sight of the component stars. From the dimensions and other known data of the orbits, the actual masses of the stars and their distances from us can be easily calculated. But the most important result of this method is the means it furnishes of testing the question whether the Newtonian law of gravitation applies to stellar systems as well as to the solar system. Dr. See shows how we may calculate the motion in the line of sight in all parts of the binary orbit. These calculations are based upon the law of gravitation and a single spectroscopic measure. If such measures be continued upon a number of pairs, while the stars complete their revolutions and the computed and observed motions in the line of sight agree throughout, within reasonable limits of error, it will constitute a strong proof of the universality of the Newtonian law.—H. C. W., Popular Astronomy.

THE ECLIPSE OF THE MOON, SEPTEMBER 3, 1895.

BY WILLIAM R. BROOKS, M.A., F.R.A.S.

The accompanying photographs of the lunar eclipse of September 3, 1895, were taken at this observatory with the equatorial telescope of ten inches aperture with photographic corrector. The pictures are direct enlargements in the telescope, the diameter of the image of the moon in the principal focus of the telescope being one inch.

Fig. 1 shows the moon before totality, and Fig. 2 as it is passing out of the shadow after totality.

The night was very clear, and all the phenomena connected with the eclipse were the most beautiful ever witnessed by the writer.

Smith Observatory, Geneva, N. Y., Nov. 20, 1895.

THE TOTAL LUNAR ECLIPSE: ITS ASTRONOMICAL VALUE.

Celestial phenomena have ever excited in the unlettered mind a wondering interest; an interest which in the early ages was seasoned with a large admixture of superstitious dread. Eclipses of the sun and moon, more often than not, were interpreted as prophetic of approaching disaster and brought much unrest to the minds of men.

Science has changed all that; and these periodic phenomena are now eagerly anticipated, and closely observed, for the astronomical data which they afford. Formerly the chief use to which the total lunar eclipse was put by the astronomer was the determination of longitude.

The moment of total eclipse is the same for every station on that half of the globe which faces the moon; and the observation of this time of totality enables us to calculate the difference of longitude between any two points of observation. Such computations however lack exactness, owing to the fact that it is difficult to determine the precise moment of totality. The varying density of the earth's atmosphere causes a varying intensity in the sun's rays that pass through it. There is consequently no sharp, clearly defined edge to the umbra or shadow, and it is difficult to tell exactly when the edge of the moon has passed into it.

The most important observation is that of the occultation of the stars, or their passage behind the moon. At ordinary times the brilliancy of the moon is such that only the brightest stars can be seen as they approach it. During eclipse, and owing to the fact that the moon has no atmosphere, stars of very faint power can be observed up to the moment at which they pass behind the planet. In determining the place of the moon by this method the occultation of certain stars is observed simultaneously at different observatories, widely separated.

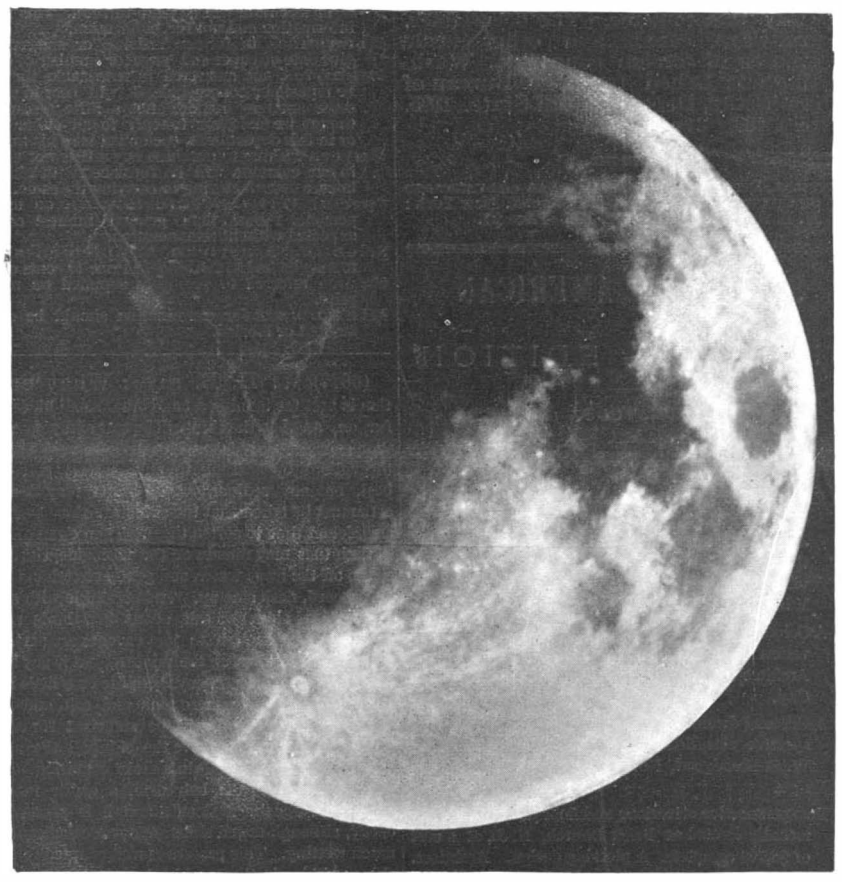
This siderial occultation, which, for the reasons above given, is very exact, is used for calculations of longitude, and to establish the diameter of the moon, its distance from the earth, and its right ascension and declination.

A total eclipse affords a special opportunity of making a spectroscopic examination of the earth's atmosphere. The sun's rays, during eclipse, pass through the atmospheric envelope obliquely on their way to the moon. Their course at this time through the atmosphere is much longer than when they fall normally to the earth, as they do during the day time. After being reflected from the moon they again pass through the earth's atmosphere before they strike the spectroscope. In this way the earth's spectroscopic lines are obtained of greater distinctness than is possible in ordinary observations.

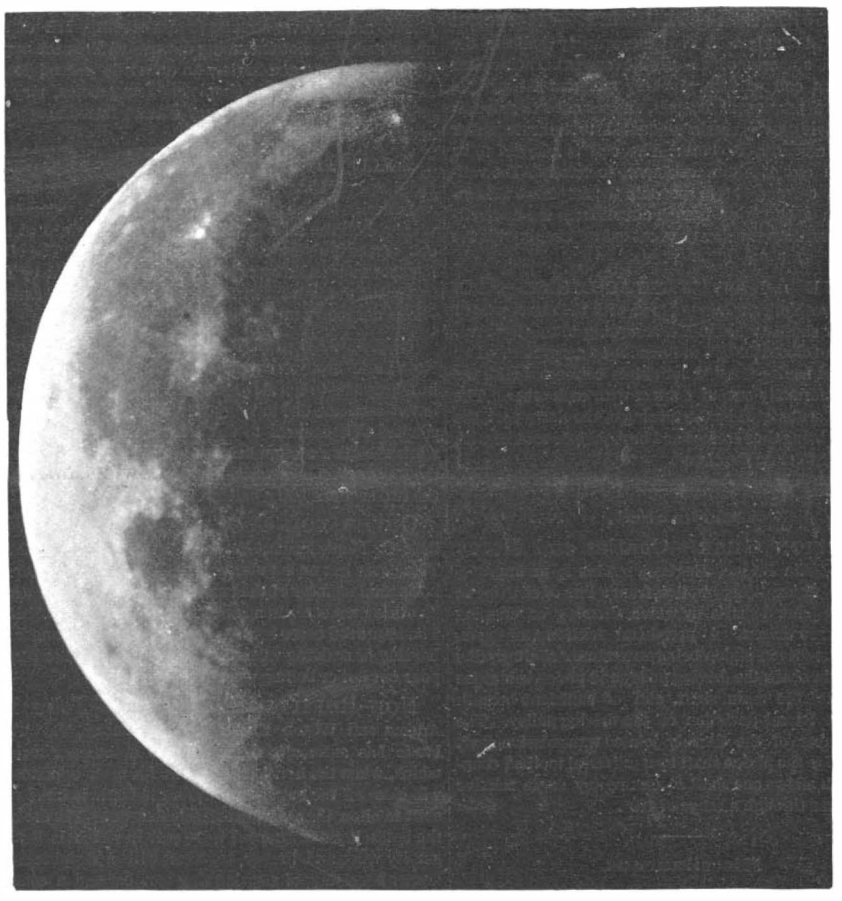
The total eclipse has been used to determine the amount of heat thrown out by the moon. During eclipse, for obvious reasons, the moon cannot give off reflected heat. Any heat that we then receive must be heat that has been absorbed from the sun, and is now being radiated. The observations show that as the light fails so does the heat; which proves that lunar heat is reflected, not radiated.

Many historical dates have been accurately fixed by means of calculations based upon the lunar eclipse. "The first olympiad, the beginning of the Christian era, and the death of Augustus are some of the events whose dates have been settled by the occurrence of lunar eclipses."

The value of the lunar eclipse is discussed in fuller detail in the November issue of Popular Astronomy by Caroline E. Furness, of Vassar College Observatory. The paper closes with an interesting description of the methods of observation adopted by the students of this college during the eclipse of September last.



BEFORE TOTALITY.



AFTER TOTALITY.

ECLIPSE OF THE MOON, SEPTEMBER 3, 1895.—PHOTOGRAPHED BY WILLIAM R. BROOKS.

The Electrolysis of Milk.

In a somewhat lengthy paper by Mr. C. E. S. Phillips, the author, after referring to some of the tests adopted for ascertaining the purity of milk, proceeds to describe experiments undertaken to discover whether electrolysis would offer a more expeditious and reliable method than those in use. On electrolyzing a sample of milk between platinum electrodes, the anode became coated with a white, spongy-looking material which increased until so thick upon the plate that it ultimately became disengaged and floated to the surface of the milk; it was observed on making experiments in this way that the white deposit consisted principally of a mixture of caseine and fat, that the milk gave off a characteristic odor during the electrolysis, and it was found to be slightly alkaline after the operation.

The liberated caseine floating upon the milk seemed to show that, owing to alkalinity of the solution, it had become insoluble; it was, however, evidently due to the lifting power of the gas bubbles clinging to it. By continuing the electrolysis further it was possible to extract practically all the solids from the milk used (30 cub. cm.), leaving a transparent solution behind; at the same time no appreciable deposit of any kind took place at the negative electrode. Tests made with litmus paper during electrolysis showed that the action was extremely local; it was, however, noticed that the froth on the negative electrode produced by a too rapid electrolysis was strongly alkaline

The formation of caseine on the positive electrode was then studied in a miniature cell under the microscope. On making the circuit, bubbles of gas appeared upon each electrode, more of course at the negative one, but at the anode a yellowish deposit grew and spread uniformly out toward the opposite electrode, a dark ridge was built up about equidistant all along the electrode, and became more definite till the band widened out on either side, and concentrated at a point immediately opposite the cathode. Very peculiar movements could be made to take place in this band by making and breaking the circuit rapidly. Photographs showing these changes are given by the author. A drop of litmus used to stain the milk showed that an acid and an alkali were formed at the anode and cathode respectively, evidently accounting for the deposition of caseine at the former. The action would appear to be similar to that which takes place when milk is exposed to air for some days; lactic acid is formed, which throws down the caseine. By electrolysis, however, the action can be started and stopped as desired, so that any portion or all of the caseine can be removed from the milk.

Next a small vessel was divided into three compartments by means of two porous partitions, and the effects recently described by M. Andréoli were tried. About 10 cub. cm. of milk were poured into the center division, while the anode and cathode compartments contained a solution of sodium chloride. On the passage of the current a deposit was formed in the center compartment on the side of the partition separating it from the anode. When all three compartments contained milk, the deposit occurred on the sides of both partitions furthest from the anode. Under these circumstances it seems that an action takes place in the milk in the center compartment. No deposit took place upon metallic plates immersed in the milk in either case. Some experiments upon the preservation of milk by means of this electrical withdrawal of a portion of its caseine were made, but with no success so far. Mr. Swinburne mentions, however, that milk can be sterilized electrolytically.

In conclusion, the author states that platinum is the most suitable material to use for electrodes in the electrolysis of milk, as the lactic acid formed attacks most other metals. Aluminum can, however, be used in certain cases for the positive electrode, but it is eventually dissolved, and consequently of little use for quantitative work.—The Electrician.

Field Experiments with Potatoes

made by the New Jersey Agricultural College are, briefly, as follows: The results of recent field experiments with Irish and sweet potatoes are at least suggestive. Manure increases the scab and soil rot. Lime increases the scab, but diminishes the soil rot and tends to make sweet potatoes round. Kainit diminishes the scab, but increases the soil rot. Sulphate of copper diminishes both scab and soil rot. Corrosive sublimate diminishes greatly the scab and soil rot. Sulphur is, all things considered, the best remedy for the scab and soil rot that the experiments suggest.

For the Irish potatoes, it is suggested that the flowers of sulphur, costing two or three cents a pound, be used with the freshly cut seed in the hopper of the planting machine.

For sweet potatoes the sulphur might be mixed with five times its bulk of fine earth, and a spoonful of the mixture placed in the hill just before setting out the plant.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR FENDER.—Theodore Cocheu, Brooklyn, N. Y. The platform of this fender, covered with wire netting, is pivotally held in brackets under the forward end of the car, the fender extending forward horizontally at a slight distance above the track. At the front end of the fender, and extending somewhat beyond it, is a guard rail, with rearwardly extending side rods, which are adapted to be pushed inward by an object coming in contact with the guard rail, and a catch is thus released by which the fender is dropped down upon the track, the lower side of the fender having shoes adapted to ride upon the rails. The fender may also be dropped to its lowermost position by the motorman or gripman pressing upon a foot lever.

CAR COUPLING.—James D. McDonald, Port Morien, Canada. This is a coupling adapted to couple with another one like itself or with the old fashioned link and pin coupling, holding the link in a manner to guide it accurately into an opposing coupling, and the link being automatically fastened. Spring buffers are arranged to take up part of the shock and prevent a link from being badly bent, and the device automatically sounds a gong or alarm when a coupling is made or the cars are uncoupled.

CATTLE GUARD.—Harvey M. Jack, Palestine, Texas. This improvement comprises sections of metallic frames and plates secured between the rails and along each side of the track, to guard a gap in the fence and keep cattle off the track, the plates having pricking points designed to prick the legs of the stock at or above the top of the hoof. Adjacent to the points or prongs are inclined surfaces on which the feet of stock will slide to bring the prongs in contact with their legs.

Electrical.

MEASURING INSTRUMENT.—Herschel C. Parker, Brooklyn, N. Y. To accurately indicate the volts and amperes of an electric current this inventor provides a coil of wire pivotally mounted between the poles of a permanent magnet, and adapted to move an index moving over a scale graduated to indicate either volts or amperes, or both. The coil is adapted to be placed in circuit with a resistance, to ascertain the voltage of a current, and to ascertain the amperage it is included in a shunt or branch circuit from the main circuit, the resistance being then cut out of circuit with the coil.

TIME ALARM ATTACHMENT.—Max Wolff, New York City. Combined with the alarm post of a clock or similar mechanism, according to this improvement, is an electrical circuit including a generator and an alarm, and having flexible terminals connected with the post and normally out of contact with each other. The terminals are twisted by the turning of the alarm post, the terminals being thus crossed and brought into contact with each other to close the circuit.

Mechanical.

FRICTION GEAR.—Charles and Harry Burgon, Malin Bridge, England. This is an improvement for transmitting motion from a line of shafting to flexible or jointed shafts by which shearing or clipping machines are driven. A peripheral friction gear is employed, the driven pinion being on a counter shaft parallel to the main shaft, the driving pulley and pinion being also parallel to the main shaft, and of sufficient breadth to permit lateral deviation of the driving pulley. The first member of the flexibly jointed transmission shaft is coupled to the pinion shaft by a universal toothed coupling which allows one shaft to assume any angle relative to the other through a range of 180°.

Miscellaneous.

TIRE INFLATOR.—Donald McKenzie, London, Canada. This is a device for automatically inflating the pneumatic tires of bicycles and velocipedes, and comprises an air pump of novel character arranged upon the inner part of the wheel rim, and having a pivoted arm with suitable tread projecting outwardly from the tread of the tire, to come in contact with the ground at each revolution of the wheel, and thus automatically keep the tire fully inflated, a safety valve preventing too high pressure.

VEHICLE STARTING MECHANISM.—Auguste M. G. de la Rochefontenilles, Paris, France. According to this improvement clutch boxes loosely mounted to turn on the rear axle and embracing the wheel hubs with spring-actuated clutch dogs are flexibly connected with one arm of an elbow lever whose other arm is connected with the draught mechanism, the arrangement relieving the horses of the sudden strain necessary to put the vehicle in motion, and the starting mechanism ceasing to act when the wheels have acquired the velocity they would have with the draught applied directly to the axles.

ELEVATOR AND DUMPING DEVICE.—Ferris J. Nowlin, Guilford, Ind. To elevate a loaded vehicle and dump the contents into a car or as required, this inventor has devised a portable device readily operated by horse power, the vehicle being returned by gravity to receive another load. The improvement comprises a sill frame and an upright frame with inclines, in combination with a two-part sectional hinged traveling frame operated by link bars and rope and pulley connections. The whole apparatus may be loaded on wagons for transportation or compactly stored.

SAFETY CATCH FOR ELEVATORS.—John S. Chase, Lansing, Kansas. To securely hold the cage of freight or passenger elevators in case of accident to the hoisting device this inventor provides a simple arrangement of a cam adapted to engage with its cam surface the guide posts for the cage, the cam being on a shaft turning on the cage, while a spring-pressed arm on the shaft is connected with the hoisting cable. Should the cable break or become slack the cams would be instantly thrown in contact with the guide post to lock the cage so that it could not descend.

BOOK BOARDING APPARATUS.—John Ring, Washington, D. C. This invention provides a simple mechanism for book binders' use by which to accurately bind and stop the boards and books in proper relation in piling. It comprises a base frame with front and rear guideways, a carrier in the front guideway having an adjustable end stop, there being underlying supports adjustable on the front guideway and having extensible sections, while side stops movable in the rear guideway have adjustable stop portions, with other novel features. It is designed that with this improvement an inexperienced person shall do more and better work than a skilled workman in the old way, the machine automatically gaging the books and boards as the piling proceeds.

PROTECTING METALLIC SURFACES.—Marion D. Fleming, Butte, Montana. For the protection more especially of pipes from corrosion by mineral waters or air contaminated with corrosive impurities, according to this invention, the metal is freed from grease, and two coats applied of a composition containing powdered silica, powdered litharge, powdered asbestos, powdered plumbago, liquid shellac and alcohol in proportions specified.

EYEGLASSES OR SPECTACLES.—Albert E. Butterfield, Portland, Oregon. By means of this improvement a full sized lens may be used in spectacles or eyeglasses for distant vision, while other lenses are so attached to the distance lenses that they may be brought over them, rendering the same glasses fitted for near work. When the glasses are to be used for distant vision the auxiliary glasses may be carried entirely out of the way, the adjustments being effected without the necessity of removing the glasses or spectacles from the nose of the wearer.

WINDOW FASTENER.—Ewing Eaches and Robert M. Kerr, Louisville, Ky. A rotatable bolt is, according to this improvement, mounted in the meeting rail of the lower sash, the bolt having a crank arm on its inner end and a handle on its outer end, and a slotted plate is secured over a recess in the meeting rail of the upper sash, the slot extending downward from the upper edge of the plate and having an upwardly curved lower end. The fastening is simple and inexpensive, may be quickly applied and does not detract from the appearance of the sashes.

AXLE LUBRICATOR.—Jesse D. Lyon, Higginsport, Ohio. This invention provides a simple and durable device for lubricating the axle from a reservoir held on the hub, the reservoir being formed at the end of the hub by the hub band and a cap. The oil is fed to the spindle by capillary attraction, aided by the motion of the bearing surfaces and by centrifugal action, due to the rotary motion of the boxing.

BEDSTEAD IRON.—Edwin F. Tilley, New York City. For rigidly attaching tubular or other iron bedposts to the side rails this bedstead iron is made in two sections, one having a rib on its outer face and adapted to be secured to the side rail of the bedstead, while the other section has a groove receiving the rib of the first section and a second groove receiving the post, the two sections being bolted together.

COVER FOR COOKING VESSELS.—William C. Mapledorum, Fort William, Ontario, Canada. This cover has an angular pivoted handle, the lower or horizontal member of the handle engaging the cover when its other member is in an approximately vertical position. The improved cover is designed to remove the danger of burning or scalding when handling a heated pot or pan to pour out hot or boiling contents.

NON-REFILLING BOTTLE.—John N. Adams and Wilton F. Jenkins, Richmond, Va. This bottle has automatic shifting valve or stopper devices which, when the bottle is held with its neck uppermost, will close off the outlet, and when the bottle is tilted will shift to allow the contents to freely flow out. The neck of the bottle has a contracted valve seat in which is held a gravity valve and keeper, together with a supplemental keeper consisting of a spring ring member and a central flexible portion. This valve device can be added to the bottle without materially increasing the cost of its manufacture.

Designs.

COAL SCUTTLE.—John W. Feeny and Roe Reilly, Elmira, N. Y. This scuttle has a flat black rising above the body of the scuttle, the projecting upper end flaring.

CUFF HOLDER.—Louis P. Kleiderer, Henderson, Ky. This device has a wavy shank portion, at each end of which is a laterally projecting pin.

CHUCK FOR HAT BLOCKS.—Ferdinand Herbin, Amesbury, Mass. This chuck has thickened side portions with beveled inner sides, there being openings in the depressed central part of the plate and opposite peripheral recesses in the thickened side portions.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

ENGINEERING CONTRACTS AND SPECIFICATIONS. Including a Brief Synopsis of the Law of Contracts and Illustrative Examples of the General and Technical Clauses of Various Kinds of Engineering Specifications. By J. B. Johnson, C.E. New York: Engineering News Publishing Company. 1895. Pp. 417. 8vo. Price $4.

Since custom has laid on engineers and architects the duty of writing specifications and contracts, it is well for them to know something of the legal ground they are forced to traverse. The leading American engineering schools have long needed a text book on the subject of the law of contracts and engineering specifications. In the absence of any such text, this department of engineering practice has received scant and meager treatment at the hands of these schools. This work has been written primarily to serve the purpose of a text book. The author is professor of civil engineering at Washington University, St. Louis, Mo., and has imparted instruction on the subject of the book for many years. The value of this work, with its wealth of technical clauses and forms, will be apparent to all engineers and architects.

STENOTYPY, OR SHORTHAND BY THE TYPEWRITER. By the Rev. D. A. Quinn. Providence: The American Book Exchange. 1895. Pp. 55. 8vo. Price $1.50.

This work gives the details of a system the principles of which can be learned in a few hours, and words may be written with a speed equivalent to two and one-half times that of the ordinary typewriter. In this system a typewriter is used. It is based on phonetics, but instead of arbitrary letter or word signs, the letters of the Roman alphabet, with figures and stops, are utilized. By a judicious collocation of capitals and letters, as also figures and stops, a complete system of shorthand has been devised.

THE CENTURY MAGAZINE. May, October. 1895. New York: The Century Company. Gilt cloth. Pp. 960. Price $3.

Such a rich, beautiful, highly instructive and exceedingly interesting volume as six months' bound numbers of the Century Magazine make can hardly be realized by those who do not see it in this form, but simply read the separate numbers as they appear from month to month. The bound volumes are also worth a place on the drawing room table for a few weeks, before being placed on the library shelves, and all good libraries should have these volumes. The most important serial is Professor Sloane's Life of Bonaparte, begun in November, 1894, a work which has thus far given large promise of being the most complete and best balanced of all the accounts thus far put forth of the life and character of the great Corsican.

SPECIAL CONSULAR REPORTS. Highways of commerce. The ocean lines, railways, canals and other trade routes of foreign countries. Washington: Issued from the Bureau of Statistics, Department of State. 1895. Pp. 763. 8vo, maps.

RECEIVED.

PHYSICAL, INTELLECTUAL, AND MORAL ADVANTAGES OF CHASTITY. By Dr. M. L. Holbrook. New York: M. L. Holbrook & Co. Pp. 120. Price $1.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion: about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(6677) W. H. B. says: What preparation is best for tanning cat and other small hides with the fur on, so that the skin will be soft and yet strong? A. Supposing the skins are dry, they should be softened throughout by soaking in pure water; soft water is best, but any ordinarily pure water may be used, and care must be taken that the skins are thus soaked only a sufficient time to soften them. Then clean off any bits of flesh that may remain on the flesh side, rinse all well, shake off the loose water, and gently stretch out and tack on a board, flesh side up. Then sprinkle with a mixture of powdered alum and salt, about two-thirds alum and one-third salt, enough to just cover every part. As the skin dries it takes up the mixture, but if any be left on the surface the second day, sprinkle on a little more water, otherwise put on more alum and salt, and sprinkle. Two to three days should be sufficient for such small skins, the idea being to give the skin all the alum and salt it will take up, while in a moist condition. This tawing process makes the hair firm, a gentle rubbing and beating softens the flesh side, and it is preserved from decay, although tawed skins are never calculated to stand much wetting. This process is well adapted for all small skins, although those which are heavier require more time, and the flesh sides are sometimes folded together, and the skins rolled up. When the skins are freshly taken off, no soaking is needed, but more care is then called for in thoroughly washing off and cleaning them, and the first application of salt and alum should be in the proportions of one-half each. It requires the judgment of a tanner to deal with skins in a dry state which may have become partly damaged before drying, and it requires special knowledge also to tell whether a dry skin is so damaged.

(6678) P. W. J. says: Can you give me some information regarding the nature of alloys? A. The following is from Hiorn's "Mixed Metals": "When two or more metals are caused permanently to unite, the resulting mixture is termed an alloy. When mercury is an essential constituent, the mixture is termed an amalgam. The general method of effecting combination is by the agency of heat, but with certain soft metals true alloys may be formed by subjecting the constituents to considerable pressure, even at the ordinary temperature. Alloys such as those briefly referred to were doubtless first discovered by the metallurgical treatment of mixed ores, from the simultaneous reduction of which alloys would be formed; or in some cases, as in ores of gold and silver, naturally formed alloys would be obtained by a simple melting process. The direct preparation of alloys by the simple melting together of the constituent metals has been enormously developed in modern times, and the attention which mixed metals are now receiving by chemists is far greater than in any period of history. Comparatively few of the metals possess properties such as render them suitable to be employed alone by the manufacturer; but most of them have important applications in the form of alloys. Even among the metals which can be used independently, it is often found expedient to add portions of other metals, to improve or otherwise modify their physical properties. Thus gold is hardened, and made to resist wear and tear, as well as to lower its cost, by the addition of copper; silver is likewise hardened by alloying it with copper; and the bronze coinage is formed of an alloy of copper, zinc and tin for similar reasons."

(6679) E. W. B. says: Can you tell me how to preserve bird skins? A. Make an incision from

the breast bone to the vent; with a small piece of wood work the skin from the flesh. When the leg is reached, cut through the knee joint and clear the shank as far as possible, then wind a bit of cotton wool on which some arsenical soap has been put round the bone; do the same with the other leg. Now divide spine from root of tail, taking care not to cut too near the tail feathers, or they will come out. Next skin the wings as far as possible and cut off The skin will now be entirely clear of the body. The skin must now be turned inside out and the neck and skin gently pulled in opposite directions till the eyeballs are fully exposed. The whole of the back of the head may be cut off and the eyes and brains taken out and their places filled with cotton wool. The whole skin should be rubbed well with arsenical soap or plain arsenic, and the neck returned to its natural position, when, after filling the body with a little dry grass or wool, the job is done. It is very easy, and the skin of a bird is much tougher than one would suppose, though, of course, they vary, the night-jar being very thin, while humming birds are fairly tough. All the apparatus required is a sharp knife and a pair of scissors, or, for large birds, a strong pair of nippers to divide the bones. For further information see works on taxidermy.

(6680) P. W. P. says: Will you kindly give me directions for the amalgamation of zincs? A. This is accomplished in several ways. 1. By dipping the zinc in dilute sulphuric acid and then dipping the end of it into a small quantity of mercury, after rubbing the surface with a brush. 2. Dissolve 1 lb. of mercury in 5 lb. of nitromuriatic acid (nitric acid 1 part, muriatic acid 3 parts), heat the solution gently to hasten the action. When a complete solution of the mercury is effected, add 5 lb. more of nitromuriatic acid. The solution should be applied with a brush, as immersing the zinc in it is wasteful. 3. To the bichromate solution commonly used in batteries, add to every pint of solution 1 drachm of bisulphate of mercury or a similar amount of nitrate of mercury (mercury dissolved in nitric acid). By employing this method, the amalgamation of the zincs is maintained continuously after the first amalgamation, which must be accomplished by method 1 or 2.

(6681) A. F. R. says: Can you give me directions for indexing? A. A writer says: Having had to index twenty-nine thousand words, I think I have a right to speak about it. In the first place I got hold of a somewhat stiffish paper (old ledger paper is excellent); then I cut it into slips of different size (one inch by two inches will be about right). I put down on each slip a word or sentence (depending on the kind of index), with page and other reference if such is necessary. When every word or sentence which I wanted in the index was noted down, I got hold of twenty-six cigar boxes, which I lettered from a to z. I now distributed those slips into the boxes. This done, I put the contents of each box in a separate paper bag, put the now empty boxes again before me, got hold of a and distributed all slips bearing words beginning with a between these boxes, thus, aa, ab, ac, ad, etc., to the end of the chapter, This done, I got hold of aa and successively ab, ac, etc., and distributed those slips further. When arranged alphabetically, I pasted those slips belonging to a in proper order on brown wrapping paper. Having treated a in this way, I took hold of b, and so on to the end of the alphahet. It took me a fortnight (six hours a day) to get through with the distribution, and after that the copying took me several months.

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December 10, 1895,

AND EACH BEARING THAT DATE.

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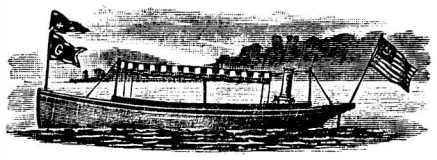

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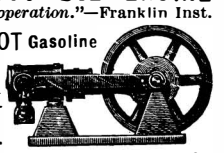

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